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1905-1906

BIENNIAL REPORT

OF THE

STATE ENGINEER

COLORADO









THIRTEENTH BIENNIAL REPORT  
OF THE  
STATE ENGINEER  
TO THE  
GOVERNOR OF COLORADO

FOR THE YEARS 1905-1906



DENVER, COLORADO  
THE SMITH-BROOKS PRINTING CO., STATE PRINTERS  
1907







No. 2—Showing Timbered Country—Large Snow Drifts. Photograph Taken Same Day as No. 1.



No. 1—Showing Burnt Timber—No Snow.





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LETTER OF TRANSMITTAL.

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Sir—I have the honor to transmit in parts I and II the report of the transactions of the department of the State Engineer for the two fiscal years ending November 30, 1906, with such recommendations as in my judgment will secure the better administration of the irrigation laws.

Very respectfully,

THOMAS W. JAYCOX,  
State Engineer.

To His Excellency,

JESSE F. McDONALD,  
Governor of Colorado.

## STATE ENGINEERS OF COLORADO.

SINCE DEPARTMENT WAS ORGANIZED, JUNE 3, 1881.

EUGENE K. STIMPSON.....	June, 1881, to April, 1883
EDWIN S. NETTLETON.....	April, 1883, to April, 1887
J. SIRE GREENE.....	April, 1887, to April, 1889
JAMES P. MAXWELL.....	April, 1889, to April, 1893
CHARLES B. CRAMER.....	April, 1893, to April, 1895
HORACE A. SUMNER.....	April, 1895, to April, 1897
JOHN E. FIELD.....	April, 1897, to April, 1899
ADDISON J. McCUNE.....	April, 1899, to April, 1903
LOUIS G. CARPENTER.....	April, 1903, to April, 1905
THOMAS W. JAYCOX.....	April, 1905, to April, 1907

## LIST OF OFFICERS

IN CHARGE OF IRRIGATION IN COLORADO, NOVEMBER 30, 1906.

THOMAS W. JAYCOX.....	State Engineer
CHARLES W. WELLS.....	Deputy State Engineer
CHARLES W. BEACH.....	Deputy State Engineer

## IRRIGATION DIVISION ENGINEERS.

NAME	DIVISION	RESIDENCE
William Rist .....	No. 1	.....Denver, Colorado.
John M. Jackson .....	No. 2	.....Pueblo, Colorado.
Dan S. Jones. ....	No. 3	.....Center, Colorado.
Arthur H. Stokes. ....	No. 4	.....Grand Junction, Colorado.
A. J. Dickson.....	No. 5	.....Glenwood Springs, Colorado.

## WATER COMMISSIONERS.

DIV. NO.	DIST. NO.	NAME	RESIDENCE
1	1	Charles I. Colwell .....	Fort Morgan
1	2	Charles M. Jump.....	Platteville
1	3	John L. Armstrong. ....	Fort Collins
1	4	Oswald Allen. ....	Loveland
1	5	A. L. Gibson .....	Longmont
1	6	Edward Autrey .....	Boulder
1	7	W. M. Davis .....	Edgewater
1	8	S. F. Couch. ....	Littleton
1	9	John W. McLean.....	Morrison
2	10	William Frizzell.....	Manitou
2	11	William Young.....	Nathrop

DIV. NO.	DIST. NO.	NAME	RESIDENCE
2	12	John Kile.....	Rockvale
2	13	Frank Kelling .....	West Cliff
2	14	Robert Burton.....	Boone
2	15	Lewis Harris.....	Rye
2	16	David E. Farr.....	Walsenburg
2	17	S. W. Cressy .....	Rocky Ford
2	18	James S. Calderhead.....	Gulnare
2	19	E. G. Duling.....	Trinidad
3	20	George C. Widman.....	Monte Vista
3	21	G. S. Lovett.....	La Jara
3	22	E. Coombs, Deputy .....	La Jara
1 & 2	23	David Collard.....	Fairplay
3	24	J. P. Sanchez.....	San Pablo
3	25	Frank Cargo.....	Villa Grove
3	26	W. R. Donnel .....	Saguache
3	27	Feles Chavez.....	Saguache
4	28	J. R. Hicks.....	Sargents
4	29	R. H. Bostwick.....	Pagosa Springs
4	30	John Cundiff .....	Bayfield
4	31	.....	.....
4	32	.....	.....
4	33	John Cunningham.....	He perus
4	34	H. M. Barber.....	Mancos
3	35	Max Antencio .....	Fort Garland
5	36	.....	.....
5	37	N. W. Nelson.....	Gypsum
5	38	Charles H. Harris .....	Carbondale
5	39	D. E. Eakins .....	Rifle
4	40	George Hider.....	Cedar Edge
4	41	W. O. Hersum .....	Olathe
4	42	Walter Farmer.....	Whitewater
5	43	J. M. Clark.....	Meeker
5	44	Arthur Collum.....	Axial
5	45	Alvin M. Soule.....	Rife
1	46	Sam E. Swire.....	Spicer
1	47	W. D. Beckwith.....	Walden
1	48	Walter G. Decker .....	P. O. Jelm, Wyoming
2	49	.....	.....
5	50	.....	.....

DIV. NO.	DIST. NO.	NAME	RESIDENCE
5	51	.....	.....
5	52	C. B. Rundell.....	Sheephorn
5	53	A. R. Plowman .....	McCoy
5	54	.....	.....
5	55	.....	.....
5	56	.....	.....
5	57	.....	.....
5	58	John B. Souther .....	Yampa
4	59	.....	.....
4	60	C. H. Smith ...	Coventry
4	61	Fred Dixon....	Paradox
4	62	John P. Morgan ...	Montrose
4	63	.....	.....
1	64	W. L. Henderson .....	Sterling
1	65	Edwin J. Dowlin .....	Yuma
2	66	.....	.....
2	67	E. M. Mears.....	Lamar
4	68	John Merling.....	Ouray
4	69	.....	.....
5	70	George P. Newton.....	Debeque

## CHAPTER I.

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### Work of the Department and Recommendations.

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#### OFFICE WORK.

During the past two years there has been a constant increase in the clerical work of this office.

The Fourteenth General Assembly enacted a law for the filing of claims for water rights, requiring every such claim, for any beneficial use, to be filed in this office, and that maps and statements thereof should be duplicate copies, which are to be examined and compared for the purpose of knowing that the copies are in fact duplicates, before either can be approved, and a certificate attached to the one to be filed in the office of the county clerk and recorder.

This duty has required almost the entire time of two clerks, who have been employed during the past two years, and their salaries taken from funds which otherwise should have gone to much needed field work, or in the study of important irrigation problems.

I would recommend that adequate appropriation should be made for the services of two filing clerks for this office.

#### DITCH RATINGS.

This office has made 124 ratings of canals during the past two years, besides a great number of miscellaneous measurements. In 1905, owing to a lack of funds, canal companies requesting ratings were charged with the expense of the same. In 1906, sufficient funds being available, canals which were in the greatest need were rated free of expense to the owners. This work was continued as long as funds were available.

I found that this policy met with general approval and the results obtained were very satisfactory.

A request was sent to all division engineers for a list of canals having a capacity of ten or more cubic feet per second and the date of the last rating.

From this list I was able to determine the canals that were in greatest need of ratings. I found many cases in which water

commissioners were using rating tables six and seven years old. I had deputies and assistants from this office visit Irrigation Divisions Nos. 1, 2, 3 and 5 and make ratings of many of the canals in these divisions. Division Engineer Stokes rated the canals in Division No. 4.

Rating tables were made out and sent to the division engineers, water commissioners and canal owners.

The duty of rating large canals properly belongs to this office, and funds should be supplied for doing the work. Such canals should be rated at least once each year, and in many cases two and three times a year. The water commissioner is thereby supplied with correct rating tables and is relieved of any implication of favoritism or partiality, and is able to discharge his duties more accurately.

In places where the conditions are suitable, I would recommend the use of the weir as a means of measurement of water for canals carrying ten cubic feet per second or less. Larger canals which are built on less grades will require rating flumes.

This office furnished division engineers and water commissioners with measurements and ratings of several places on the Platte, Arkansas and Purgatoire rivers.

As much time as was possible was devoted to this line of work, and experience taught that it could be enlarged upon with profit to our canal companies.

The accurate distribution of water between water districts lying on the same stream is an important duty of our irrigation officials, and it is to be hoped that funds will be provided by our Legislature to enable this department to devote more time to this work.

### RIVER BULLETINS.

In Division No. 2 daily bulletins were issued by John M. Jackson, irrigation division engineer Division No. 2, with the assistance of the water commissioners, in water districts Nos. 11, 12, 14, 17 and 67, and the aid of information gathered from some private sources. This office assisted in the work by furnishing rating tables of the several river stations and of the canals. These reports gave the amount each day that every canal between Canon City and the State line was carrying. Reports were received each day from the caretakers of the Sugar Loaf and Twin Lakes reservoirs. The method of making out the reports was as follows:

At about 7 o'clock in the evening the division engineer would call up by telephone one water commissioner after another and receive the daily report of the conditions of canals and rivers as they existed at the close of the day. These conditions were recorded upon the report and the reports were mailed and in the



canal owners' hands next morning. The length of river covered was 300 miles.

It seems remarkable that daily bulletins could be issued covering such an extent of territory and give accurate reports of the amount of water that every canal along the entire length of river was carrying and the amount of water in the Arkansas river at the head of each water district; yet such was the case.

The reports served many beneficial purposes. The information obtained was of great value. It gave several days' notice of changes in the river and allowed the irrigator and canal superintendents to prepare for the change. The irrigation interests received better service from the water commissioners and division engineer.

An examination of the daily report would show to a canal owner on the lower end of the Arkansas river if the water commissioner in District No. 12 was on duty and giving reliable reports, and so on along the line. The water commissioners were careful to keep posted on their districts. Each water commissioner was held responsible for his own district, and any errors in his report would be checked up the next day by canal superintendents in his own district. These errors were always to be avoided. These conditions insured accuracy and better service on the part of the water commissioner.

As funds were not provided by the State, the expense of postage, blanks, telephone tolls, clerk hire and other incidental expenses was borne by the Arkansas Valley Ditch Association. The service cost the canal companies \$519.50 for four and one-half months, through the irrigation season. The expense of keeping up rating stations was borne by this office, except that of the two stations at Canon City and Pueblo. Results from these stations were furnished by the United States Geological Survey.

This system of daily reports is nothing more or less than publicity applied to a most important branch of our public service, and the results were all that could be desired.

It is hoped that this system of issuing daily river bulletins will be adopted in other parts of our State. Funds that are at the disposal of this department do not permit of an expenditure large enough to do all the work. The bulletins can only be issued with the co-operation of the canal companies interested.

## CONCERNING WATER COMMISSIONERS.

There have been recommendations made by all the State engineers, since 1891, for amendments to the law regarding the appointment and method of payment of the salaries of the water commissioners of the State, and thus far there have been no changes made.

The statute under which these appointments are made was enacted by the Sixth General Assembly, in 1887, by which the Governor is requested to appoint a man from a list of persons presented to him from the several boards of county commissioners of the counties into which water districts may extend.

Frequently, in the past, the applicant selected by a board of county commissioners has been without any qualifications as to performing the duties of the office, and lacking in the judgment that is so essential to satisfactorily distribute the waters of a stream between the different appropriators.

These men should be chosen from those who have had some experience in the duties of the office, and at this time there are a number of such men in every water district, and the Governor should not be obliged to appoint a person solely upon the recommendations of a board of county commissioners, without having any discretion in the matter. It makes him but little better than a mouthpiece to the board of county commissioners.

The method of payment of the salary of a water commissioner is that he shall render an itemized statement of the time spent by him in the duties of his office, verified by oath, to the boards of county commissioners into which the water district may extend, and they shall pay its pro rata share thereof, or in case the water district extends into only one county, then to the board of county commissioners, who shall allow the same.

Since the law was enacted it has often occurred that boards of county commissioners have found reasonable ground, although in many cases not legal, for refusing to pay the salary account, and have often opposed payment on the ground that very little, and, in some cases, no services at all, were rendered or needed, and claim it is unfair to be compelled to pay a pro rata amount for services which they neither need nor get, and frequently the county warrants are quoted at a discount, so that when disposed of the commissioners suffer serious diminution on the amount due.

The water districts, as usually defined in the statutes, shall consist of all lands irrigated by water taken from a certain stream and its tributaries, between designated limits, and the counties into which the water district may extend shall be liable for their pro rata share of the cost of the distribution of the water conveyed from these sources to such lands, notwithstanding the area of lands irrigated in one county may be but a small proportion of the area in the district.

Owing to new construction and extension of old ditches since the districts were first formed, there are many instances where the water from a stream or tributary is now carried into adjoining counties, thus bringing these counties into the water district, and should the portion of a ditch in an adjoining county

be abandoned, or the supply of water be discontinued, then another adjustment of the water district boundaries would have to be made, and thus it is evident that the water district lands in different counties may vary from year to year, month to month, or even from week to week, causing varying and annoying conditions, requiring a new determination of district limits, depending upon whether or not a certain ditch is being intermittently or continuously used.

A further complication has been found to exist where water is brought from across the divide from North and Middle parks and distributed on the eastern slope, and strictly under the law, the water commissioners from the diverting district should be required to distribute this water, and the lands irrigated thereby should constitute a part of his water district.

These conditions show the desirability and a necessity for a change in the law regarding the payment of the salary of a water commissioner by the counties into which his district extends, and that the present statutes, enacted years ago, are wholly inadequate.

It has been suggested by former State engineers that all these uncertainties and annoyances may be avoided by having the water commissioners classed as State officials, and paid from the general fund of the State, by regular appropriations, as are other State officials.

I am of opinion that this arrangement would solve the difficult problem, but would require the division of the water districts into different classes, having different salaries attached, depending upon the requirements of the work, length of the irrigation season, and the necessities for the distribution of water for beneficial purposes, other than irrigation, and should be so safeguarded as only to allow the official to be paid for services actually rendered.

There is a possibility that under a salary the term of service may be unwarrantably extended, by making conditions that would not otherwise be deemed necessary.

The compensation to be paid the water commissioner for services should be a stated monthly amount, paid upon certificate examined and approved by the irrigation division engineer, by vouchers approved by the State Engineer. The term of service should be limited to a certain period, covering the irrigating season of the district, and subject as to length of time by the orders of the irrigation division engineer.

The term of office and salary of assistants or deputies of a water commissioner to be under the same requirements of law as are those of the water commissioner.

In connection with and pertinent to the payment of salary to water commissioners and their deputies, I would respectfully call the attention of the Legislature to the statutes of the



State of Idaho, approved March 11, 1903, which provides a method whereby the cost of distributing the water is made a charge or lien upon the property or land receiving the water in the proportion that the water received by each tract bears to the whole amount of water distributed.

The bill is to be paid by the board of county commissioners and added to the taxes on the land receiving the water, and another provision provides for water distributed to an organized canal company, the cost of distribution is taxed against the canal, and no canal is exempt from the payment of such taxes.

The act is as follows, to wit:

"Sec. 29. Water masters herein provided for shall each be entitled to pay at the rate of and not to exceed four dollars per day for each day he shall be actually employed in the duties of his office. Said water master shall make up a sworn statement which shall be verified by the water commissioner, which statement shall show the number of days said water master had devoted to the distribution of such water, and the number of days his assistant or assistants have devoted to the same purpose, and such statement shall also show the volume of water, stated in cubic feet per second, he has, by virtue of the allotment of said waters, delivered to each user each day, and shall describe the lands to which said water was so delivered. The pay for the services of said water master shall be a charge against the land of the users to which said water was so delivered, the amount charged to each user bearing the same proportion of the total expense for the services of said water master and his assistants as the volume of water received by said user bears to the total volume delivered to all users by the said water master and his assistants. This statement, which shall show the proper distribution of the said expenses among the various users, shall be filed with auditor and recorder of the county or counties in which the said water was delivered; Provided, That when any portion of the allotted waters are distributed by said water master to the canal of any duly organized canal company, the amount of the expense chargeable for such services shall be a charge against such canal, and the amount of such a charge to be paid by the county in the manner herein provided, shall be charged as a tax against such canal, which tax shall be collected in the manner provided by law for the collection of other taxes, and that no canal in this State shall be exempt from the payment of such a tax

"Sec. 30. A bill, based upon such statement for the services performed by the said water master and his assistants, shall be presented at a regular meeting of the board of county commissioners, who shall order a warrant issued to said water master or his assistants on the current expense fund of the county. The auditor and recorder of said county shall add to the amounts charged to the land of the users and to such

ditches to which said water was delivered to the taxes of said land or ditches, as may be, for the following year, which shall be collected along with other taxes and be turned into the current expense fund of the county."

The water commissioners mentioned herein have the same duties as our irrigation division engineers, and water masters are similar to the water commissioners, under the laws of this State. The adoption of this method of collecting the cost of water commissioners' services would have a decided effect upon the more economical use of the water by the appropriators, as they would be personally interested in preventing an excessive diversion from the streams, limiting the amount to that which could be beneficially applied to the land, thus lessening the waste. The headgates and rating flumes or weirs would be constructed and maintained in good order, so that the amount of water passing would be correctly measured, as this amount would determine the volume charged to the lands under the ditch in taxes.

On account of the less amount of water which would be diverted by the older priorities, the junior appropriators would have a lengthened season, and this would increase the area of land irrigated.

The duty of the water under each ditch will be more closely determined, and this result will show whether or not an excessive amount is being applied to the land, which may result in a more economical use of the water.

The water commissioner will be required to attend very strictly to the duties of the office, and be personally familiar with the conditions of each ditch in the district, as upon the accuracy of his reports, which will be subject to inspection by every water user, will depend the apportionment of the cost of his services to the lands of the parties receiving the benefits of the services rendered.

Without having the cost of distributing the water made a lien upon the land that receives the use of the water, the method of allotting the cost to the counties into which a water district may extend, based upon the volume of water delivered to the lands in each county, would appear to be more equitable than the present system, as each county would then only pay for what it receives, and the volumes can be determined by the water commissioner from his visits to each ditch in the district, and when approved upon examination by the irrigation division engineer, can be used as an equitable basis for the apportionment of the cost of the services of the water commissioners to the respective counties.

#### WATER COMMISSIONERS' REPORTS.

In compliance with section 2455, Mills' Annotated Statutes, this office had prepared blank report forms for daily and

weekly reports of the water commissioners to the division engineer. These blanks were bound in tablet form with a second sheet. A carbon sheet was supplied and the water commissioner was enabled to retain an exact copy of his report. Each water commissioner was furnished, through the division engineer, with a tablet containing fifty blank report forms. Reports to be made out at least once each week and in some cases daily. By means of these reports the division engineer knew what was going on in all parts of his division.

Blank report forms for the water commissioners' annual reports were caused to be printed and distributed by the division engineers. In addition to the crop data heretofore gathered, space was provided for data about reservoirs and reservoir water and the part it takes in the agriculture of our State. This information is of great interest and value.

The information contained in the water commissioners' annual reports is daily sought after in this office. It represents the only official history of canals reported upon as to amount of water carried, number of days water was carried, and kind and acreage of crops grown. In case of litigation over water rights, these records are of great value.

During my term of office I made a special effort to secure as complete and accurate returns as possible from the water commissioners for the statistical value they have. Blank field books were furnished the water commissioners. A space was provided for each ditch and reservoir in a district. If one book did not contain enough blank spaces, several books were provided. The field books were to be carried by the water commissioner, and all official acts were to be recorded as they occurred. Notes were to be made on every canal visited as to amounts of water carried, date water was turned in or shut out of canal. Notes on crops were to be taken from day to day, and when the time came for making up the annual reports, all the information necessary was supposed to be in the field books.

## REPORTS OF DIVISION ENGINEERS.

From the daily and weekly reports of the water commissioners, the division engineers were required to report to this office once each week, the general conditions existing in the various irrigation divisions, as to amount of water distributed, latest decree receiving water, commissioners reporting and those failing to report and reasons for such failure, disputes pending and settled, and any other items affecting irrigation.

This system of reports enabled this office to supervise the work of distributing water in an efficient manner and to exercise a general control over all irrigation officials.







Hydraulicking Materials for Inside Slope of Terrace Reservoir, Conejos County.



Hydraulic Plant, Inside Slope of Reservoir—Terrace Reservoir, Conejos County.



Hydraulicking Material for Outside Slope of Terrace Reservoir, Conejos County.



Depositing Material Outside Slope of Reservoir—Terrace Reservoir, Conejos County.





## RESERVOIRS.

The filings made for reservoirs in this office for the year ending November 30, 1905, were 310, and for the year ending November 30, 1906, 911, or a total of 1,221.

This increase shows that a strict search is being made for every available site that may be discovered, for the purpose of impounding the unappropriated waters of the State.

The claims for these reservoirs are not confined to purposes of irrigation, but include every use to which water may be put, and largely for hydro-electric power plants, and not a few for storing water to be utilized for any beneficial purpose, and also for the sale of the waters.

Every class of reservoir dams and embankments known to the engineering profession are proposed for construction, and as a faulty structure may become a menace to the peace and lives of the people living upon the lands in the lower valleys, besides causing untold losses of property, should a break occur, it is necessary that the State should exercise its police power regarding their construction.

A very large proportion of the dams to be built are of earth work, and there are many persons who entertain the belief that for the construction of earth embankments but little skill is required, as the work is not considered to involve scientific problems, but where questions of stability, selection of site, preparation of foundation, choice of materials and the proper design, as well as superintending the work while in progress, are taken into consideration, a very considerable amount of theoretical education and practical experience are absolutely necessary if success is to be attained.

In view of the large number of reservoir dams that will be constructed in the next few years, I deem it of great importance that sufficient funds be appropriated for the use of this office, so that an examination can be made of every proposed dam previous to and during its construction.

The present law regarding the construction and filling of reservoirs is chapter 126, Session Laws, 1899, and I would recommend that amendments be made to several sections, for the purpose of better carrying out the provisions of this act. That the plans and specifications for a reservoir dam or embankment be prepared by a competent civil engineer and presented for approval a sufficient length of time previous to the commencement of construction, so as to enable an examination of the site and materials to be made.

That the plans and specifications as presented for approval may be rejected by the State Engineer, if found unsatisfactory from any cause, and require such plans and specifications to be amended so as to conform to his requirements.

That no reservoir dam or embankment shall be commenced before the plans and specifications are approved and a permit issued by the State Engineer that the work may proceed.

That the salary and expenses of a deputy appointed to attend to the supervision of construction, where necessarily employed for such purpose, shall be paid by the owners, and if not paid within thirty days after presentation, shall become a lien on any land or property of the owner.

That when complaint is made to the State Engineer regarding an unsafe condition of a reservoir, or that it is being filled with water to an unsafe extent, the fee advanced by the complainants shall be refunded to them, if the statement is found upon examination to be true, and the expense incurred in such examination shall be paid by the owners of the reservoir, and if not paid within thirty days after presentation, shall become a lien on any land or property of the owner.

That a person or company should not have the right to use a natural stream, from which a supply of water for domestic or sanitary purposes is taken, for the purpose of conveying water from a reservoir, the impounded waters of which are detrimental to health, and should be required to so maintain the reservoir as not to injuriously affect the water for that use.

The fee for the examination and approving plans and specifications for each reservoir dam is one dollar for each five thousand dollars of the estimated cost thereof. See chapter 128, Session Laws, 1903.

Usually, under this provision of the statute, the fee received for the examination of the plans and specifications of a proposed reservoir dam or embankment is a very small amount, and I would recommend that the amount of the fee be graduated in proportion to the height of the dam or embankment as a more equitable method and one more nearly in accordance with the time and skill required in the examination of the plans and specifications, and with the importance of the work, which increases rapidly with the height, and I would suggest that the fee be fixed at the rate of one dollar for each foot in height of the proposed dam.

## SELECTION AND RECLAMATION OF DESERT LANDS.

(Carey Act.)

By an act of congress, approved August 18, 1894, the Secretary of the Interior, with the approval of the President, is empowered to contract and agree to patent to states having desert lands, not to exceed 1,000,000 acres of such lands under certain conditions.

The Tenth General Assembly of Colorado, by an act approved March 15, 1895, accepted the conditions and the grants of land



to the State under the provisions of said act of congress, and provided for the manner in which the irrigation, reclamation, occupation and disposal of the same should be carried out.

The enactments of the State Legislature, which are in conformity with the provisions of the congressional act, stipulate that the selection, management and disposal of said lands shall be vested in the State Board of Land Commissioners, and also provide in detail for the manner of procedure in selecting, reclaiming and disposing of this land and specify the several steps to be taken from the first request for the selection of the land to the final disposition of it to settlers, and it is therefore unnecessary to here present a repetition of the law.

An act of congress was approved June 11, 1896, whereby a provision for a "lien is authorized to be created by the state to which such lands are granted, and where created shall be valid on and against the separate legal subdivision of land reclaimed, for the actual cost and necessary expenses of reclamation and reasonable interest thereon from the date of reclamation until disposed of to actual settlers, and when an ample supply of water is actually furnished in a substantial ditch or canal, or by artesian wells or reservoirs, to reclaim a particular tract or tracts of such lands, their patents shall issue for the same to such state without regard to settlement or cultivation."

I would recommend that the Legislature, by suitable enactment, should accept this grant of congress, if it be deemed necessary so to do, to receive the benefits of this congressional legislation.

This act allows the construction company, which contracts to build the canal, ditch or reservoir for the reclamation of the land, to mortgage its equity in the project, for the purpose of obtaining the money required to properly complete the necessary works.

Since the approval of this act, March 15, 1895, six applications have been received to reclaim lands under the conditions prescribed by the Carey act.

Of the six applications, one was withdrawn, two cancelled, and three are taking advantage of the act.

Below is a brief description of the three propositions which are taking advantage of this act.

The Colorado Realty and Securities Company made application on January 10, 1903, for 37825.47 acres of land in Routt county, lying in T. 12 N., R. 93 W.; T. 12 N., R. 94 W.; T. 11 N., R. 94 W.; T. 9 N., R. 95 W.; T. 10 N., R. 95 W.; T. 11 N., R. 95 W.; T. 9 N., R. 96 W.; T. 10 N., R. 96 W., of the 6th P. M.

It was proposed to water these lands from the Snake river, with a canal 49 miles long and having a capacity of 632 cubic feet per second. The estimated cost of canal, headgates and dam

is \$201,500.00. The lands were examined and plans of the proposed work approved by the State Engineer on January 8, 1903.

John T. Noonon made application for 2,200 acres of land in T. 4 S., R. 5 W., of the 6th P. M. These lands were to be irrigated by storing the flood waters of Muddy creek in reservoirs. Estimated cost of reservoirs is \$30,000.00. This application was approved by the State Engineer on July 28, 1904.

During my term of office but one application was received. The Colorado Land and Water Supply Company made application to the State Land Board on April 8, 1906, for 16277.5 acres of land lying in T. 33 N., R. 7 W.; T. 33 N., R. 8 W.; T. 34 N., R. 8 W.; T. 33 N., R. 9 W., all of the N. M. P. M.

It was proposed to build a canal 36.86 miles in length, having a capacity of 250 cubic feet per second. This canal is to derive its supply of water from the Los Pinos river.

I made a trip of inspection to view the proposed site of headgate and canal, and examined the lands.

An examination was made into the available supply of water.

Becoming satisfied that the proposed canal and the watering of the lands was feasible, I approved the application and so reported to the State Land Board.

### IRRIGATION DISTRICTS.

The present law in relation to irrigation districts was passed by the Fifteenth General Assembly, Session laws 1905, chapter 113, in lieu of the one passed by the Thirteenth General Assembly, and of course remedied many of the apparent defects in the former law, but, in my opinion, there are still several serious defects in the present law which should be called to the attention of the Sixteenth General Assembly.

This law is designed to enable the users of water to own and control their own irrigation works, and to administer the business affairs thereof. It invests the districts with the usual powers of a quasi-municipal corporation, giving them power to construct reservoirs, canals and laterals, to issue bonds for the payment of the interest and principal of such bonds.

The bonds so issued are valuable as investment securities, and there should be no serious difficulty in selling them at par if the formation of the district and voting of the bonds are properly safe-guarded, and the legal steps therein specified carefully followed, and it is to this portion of the law, among others, that I desire to call particular attention.

Under the provisions of this act the settlers are enabled to combine for the immediate construction of needed irrigation works for the full development of their farms, and under intelligent, co-operative management, the same quantity of water can be used to raise larger and better crops.

The duty of water is much higher under the intelligent management of district officers therein provided for, and the cost of maintenance of the works, when carefully safe-guarded, is reduced to a minimum.

The assessments for the payment of construction should not be burdensome, as the bonds are paid in a series of years, and the united action of the settlers enables each to bring his farm into cultivation at an earlier date and at a much less cost than would be possible if acting individually.

Although the quasi-municipal power vested in an organized irrigation district may be considered the most essential feature, still I am of the opinion that a feature no less advantageous to the district is the local community interest in the management of its affairs, by means of which each district can by actual experiment adopt the best methods for maintaining such works, and distributing the water to the greatest advantage to each settler.

The organization of these districts, in my opinion, forms the best method yet developed for rapid, economical and successful development of the arid portions of the State. It has the advantage of getting the settlers of the State locally interested in the discussion of all matters pertaining to local conditions, the nature and growth of crops, the character of the soil, the amount of water necessary to irrigate each kind of land, the minimum cost of improvements, minimum expense of operation, and like subjects, upon which the success of the settler so much depends.

Another matter of importance is the comparative small expense incident to the management of the district affairs, as each community has men eminently qualified to carry on the business of the district. All questions pertaining to district matters can be adjusted without recourse to the courts, and without loss of time and delay that unfortunately usually attaches to court proceedings.

The present law provides that to institute the organization of a district, a petition must be presented to the board of county commissioners of the county within which the land is located, signed by a majority of the resident free-holders owning the lands therein, and that such petitioners shall select a committee of three to present the petition to the board of county commissioners, and if the latter allow the same, they shall enter an order calling an election for the purpose of determining whether such district shall be organized, and by such order shall submit the names of one or more persons from each of the three divisions of such district, to be voted for as directors therein. In this connection I would suggest that the petitioners, who naturally are more conversant with local affairs, and probably better acquainted with local people, should



be allowed to submit the names of two or more persons from each division of such district, to be voted for as directors.

Section 4 of the act provides for the manner of calling the election, and in this connection I would suggest that the county clerk and recorder of each county in such district be required to furnish a list of the electors qualified to vote at such election, for the use of the judges holding such election, and that such judges be required to make and return to the board of county commissioners a list of all the electors voting at such election.

Section 5 provides for the canvass of the votes, but makes no provision for a permanent or temporary record of the names of the electors or of the number of votes cast. In this regard I would suggest that as fraud and illegal voting may exist in such elections,—as experience has shown exists in other elections,—that the board of county commissioners should be required to keep the returns of the election, amended as above suggested, for a reasonable length of time within which a review could be had by the courts; that a review thereof may be had by the County Court when the irrigation district is all included within one county, and by the District court when such land is in two or more counties, providing such application for review be made within ten days after the canvass of such votes.

Section 6 provides that each member of said board of directors shall execute an official bond in the sum of three thousand dollars (\$3,000.00). In my opinion this bond is entirely inadequate to the powers, duties and responsibilities of such office, and should be a graduating bond, dependent upon the value of the bonds and property coming within the disposition of the board.

Section 9 provides for the canvass of the votes, but does not provide for a review of such canvass, and in my opinion the law should be amended to allow a review of the canvass to be made by the County Court where the district is entirely in one county, and by the District Court where the land is included in two or more counties, provided the application for such review shall be made within ten days after the canvass has been made, and to make this effective the law should be further amended in making it the duty of the board to keep the election returns for some certain period of time.

Section 12 gives the board of directors the right to acquire land, water rights, franchises and other property necessary for the construction, use, maintenance, repairs and improvements of its canals, ditches, reservoirs and water works, and the further right, by purchase or condemnation, to acquire rights of way for the construction or enlargement of any of its ditches, canals or reservoirs, also lands for reservoir sites. In my opinion, this law should be amended by providing that when the value of any such property shall exceed the sum of five thousand dollars (\$5,000.00), the question of acquiring the same should

be submitted to a vote of the qualified electors of the district, but not until an appraisalment has been made by a board of three appraisers, one selected by the board of directors of the irrigation district, one by the board of county commissioners of the county in which the office of the irrigation district is situated, and the State Engineer, or some one designated by him, shall constitute the board, and the valuation placed upon the property by the board of appraisers, or a majority thereof, shall be the amount that can be paid or offered to be paid for such property by the board of directors of the irrigation district, and if such amount, or less, will be accepted by the owners thereof, then the same shall be submitted to the electors as above provided.

Section 19 provides for the assessment of the lands in an irrigation district for the purpose of paying the principal and interest on the bonds and other necessary expenses, and further provides that in no case shall any land be taxed for irrigation purposes under this act, which, from any natural cause can not be irrigated, or is incapable of cultivation. In my opinion, such power placed in the hands of an assessor would lead to serious results. In the first place, it would not be fair to the other resident free-holders of the irrigation district to have their individual indebtedness increased at the option of each assessor who might differ from his predecessor as to the character of the land.

Section 3 of the act provides for the including or excluding of certain lands in the irrigation district, by the board of county commissioners, after the petition has been presented to it, and before the question of the organization is submitted to the electors, and it appears to me that if the power so vested in the board should be more safe-guarded, that its decision in this regard should be final in the premises, and thus exclude the assessor from any discretion in the matter. If for any cause portions of the land thus included in the irrigation district should subsequently become incapable of cultivation, as for instance, by seepage or from other similar causes, then in such case the matter could be determined by either the electors in the district or by the board of directors, subject, however, to a review by the courts.

For an additional safe-guard mentioned in this connection, I would suggest that after the petition has been presented to the board of county commissioners, and before it is acted upon, that an application be made to the State Engineer for a survey of the lands included in the application, for the purpose of determining the lands subject to irrigation and not already covered by some other irrigation system, and for an examination to ascertain the adequacy and permanency of the water supply proposed to be used for the irrigation of the lands in the district, and for the purpose of determining whether or not all the lands included in the district are susceptible to irrigation from the proposed system of water works.



After such survey and report has been made, that a notice should be published notifying all those interested that on a certain day a hearing will be had, at which time those desiring to be excluded from said irrigation district or desiring to be included therein may be heard. After such hearing has been had, and before the question of organizing the district shall be finally presented to the electors, a map of the land and number of acres included in such prospective district should be made and copies posted at each irrigation district voting precinct, and also a description thereof given in the notice of election. This would enable all to be informed in regard to the number of acres included in the irrigation district, and would prevent any one from voting at said election whose land was not included therein, and who was not a qualified elector to vote at such election.

In regard to the persons allowed to vote at such election, I would suggest that to those entitled to vote under the present law, be added all of those qualified electors of the county who have lands included in said election district.

Another serious defect in the present law, and which in my opinion works a hardship upon some persons included in said district, is the fact that no provision is made for the building of laterals. As the law now stands, provision is only made for the building of reservoirs, canals and main ditches, so that those who are fortunate enough to be in the immediate vicinity of such reservoirs, canals or ditches, can have the water placed upon their land at a moderate cost, while those living at a distance, although paying the same amount per acre for the water, are compelled to go to the additional expense of building laterals to convey the water to them. To remedy this I would suggest that the irrigation works constructed by the irrigation district should convey the water to a point no farther than one-half mile from each quarter section of irrigable land that is included therein.

Another serious defect in the law, which has been shown by experience, is the manner of letting the contracts for the construction of the ditches, canals and reservoirs, and for fixing the amount of the bonds to be issued. In order that these bonds may be saleable, it is essential that the bond-holders be fully protected, and this can be done only by having the security ample and substantial. It is equally important that the settlers obtain the actual value of the amount to be expended, and to insure this I would suggest the following mode of procedure:

First—After the petition has been presented to the board of county commissioners, and the hearing has been had in accordance with the suggestions above named, the question of forming an irrigation district should then be presented to the people, and with no other issue included—in other words, although the district may have in view the purchasing of other irrigation systems, or similar plans, still this should not be submitted at the same election, for it in a way prevents the people from voting

upon the direct question of whether or not they wish to form an irrigation district.

Second—When a district has been duly organized, before advertising or submitting the question of bonds to the electors, an estimate of the probable cost of construction of an efficient irrigation system should be made. To do this I would suggest that a competent engineer be employed by the board of directors to make preliminary surveys of the reservoir sites, canals and ditches, and of the probable cost of construction, and that bonds in an amount sufficient to cover this cost be submitted to the vote of the qualified electors of the district.

Third—After the bonds have been voted in a sufficient amount to complete a practical irrigation system, I would suggest that a competent engineer or engineers be employed to complete the plans, specifications and estimates of cost in detail, and that before advertising for bids, these plans, specifications and estimates should be referred to the State Engineer for his inspection and approval, and after such approval that due notice be given by publication of the letting of a contract to perform the work according to such plans and specifications, subject, however, to the sale of bonds sufficient to perform said work.

Fourth—That no bonds shall be given to contractors for constructing said irrigation works at less than par, and then only after the plans and specifications and the estimate of cost of said irrigation system have been passed upon and approved by the State Engineer, nor shall bonds be given for the purchase of reservoirs, canals or ditches already constructed, exceeding in value the sum of five thousand dollars (\$5,000.00) without first having such question submitted, and approved by the qualified electors of the irrigation district.

Fifth—That whenever a canal or ditch already constructed can not be obtained by said district at a reasonable cost, the law should provide that the same may be obtained by condemnation proceedings, or that the district be given the power to parallel the same with another canal or ditch, so as to avoid the necessity of a joint ownership between the district and an individual or corporation.

Below is a tabulated list of irrigation districts formed in this State, together with much pertinent information concerning them :

NAME OF DISTRICT	Date of Organization	Name and Address of Secretary	Bonds Voted	Bonds Sold	No. acres of land proposed to irrigate	No. acres of land previously irrigated	No. acres of land to be Reclaimed	Votes cast at last election
Bent and Prowers .....	July 23, 1906	A. E. Downer, Lamar .....	\$1,300,000	None	75,000	None	75,000	20
Bijou .....	July 1905	Galway Layton, Fort Morgan ..	750,000	\$700,000	40,000	3,000	37,000	25
Fort Morgan .....	1904	B. W. Jackson, Fort Morgan...	170,000	139,500	12,500	12,500	None	43
Grand Valley Irrigation District No. 1	Oct. 26, 1903	H. E. Wagner, Fruita .....	585,000	None	30,000	1,000	29,000	23
Grand Valley Irrigation District No. 2	Jan. 20, 1904	Chas. Linn, Palisade, .....	180,000	None	5,160	None	5,160	12
Green City .....	June 19, 1906	E. E. Moore, Masters .....	46,000	40,000	2,000	None	2,000	12
Hillrose .....	Feb. 20, 1905	D. D. Monroe, Hillrose .....	70,000	48,500	12,000	12,000	None	30
Julesburg .....	July 1904	E. J. Fredricks, Julesburg .....	465,000	465,000	22,500	7,500	15,000	21
Mesa County .....	Jan. 12, 1906	R. H. Bancroft, Palisade, .....	100,000	100,000	2,600	100	2,500	15
Montezuma Valley .....	Dec. 7, 1901	W. F. Mowry, Cortez .....	795,000	None	50,000	15,000	35,000	59
Orchard Mesa .....	Jan. 20, 1904	H. E. Wagner, Fruita .....	175,000	None	3,500	520	2,980	16
Otero .....	1902	Geo. A. Kilgore, La Junta .....	460,000	300,000	20,000	4,000	16,000	30
Palisade .....	Oct. 31, 1904	Fred Jaquette, Palisade, .....	160,000	160,000	5,600	2,800	2,800	141
TOTALS .....			\$5,256,000	\$1,953,000	280,860	58,420	222,440	

## REPORT ON STATE RESERVOIRS.

April 28, 1906.

To His Excellency,

JESSE F. McDONALD, Governor,

Denver, Colorado:

Sir—I have the honor to submit a report on the present condition and use of the reservoirs constructed by the State, under appropriation acts of the Eighth General Assembly (S. L. 1891, pages 345-356).

The total cost and quantity of stored water are as follows:

	COST	ACRE-FT.
Apishapa.....	\$ 14,771.80	459
Monument.....	33,121.53	856
Hardscrabble.....	9,997.31	102
Chaffee Co.....	14,654.24	205
Saguache.....	30,000.00	954
	\$102,544.88	2,576

Which is \$39.81 per acre-foot for the amount of water impounded.

Under an act of the Twelfth General Assembly, the charge and control of the reservoir was given to the county in which it is situate. (See S. L. 1899, page 350.)

## APISHAPA RESERVOIR.

Situated in Las Animas county, in the Metote canon, between Trojilla and Apishapa creeks. The water shed area of Metote creek is about four square miles, and the reservoir is filled by a ditch about two miles long from Trojilla creek, which has a drainage area of thirty square miles. It has an earth dam 800 feet long on the crest, 16 feet wide on top, having a 3 to 1 riprapped inner slope and 2 to 1 outer slope, and a maximum height of 42 feet, with two 16-inch cast iron outlet pipes; total cost, \$14,771.80, and impounding 459 acre-feet of water, covering 52.7 acres. The elevation of the reservoir is about 7,000 feet, and was completed in 1892, being constructed under the supervision of State Engineer Maxwell. The entire flow of Trojilla creek is appropriated and used by prior locators, during the irrigation season, so that the early spring flow and heavy rain storms later in the season must be depended upon for the filling of the reservoir. The supply



ditch is of such dimensions that when running full, it can fill the reservoir in two days.

I am not informed that any use has ever been made of this reservoir, either by any person interested, or by the county commissioners.

In reply to inquiries regarding the reservoir, the county clerk writes: "I have been instructed by the board of county commissioners of this county to inform you that the county has never taken any action in taking charge and control of the Apishapa reservoir in this county, and it has done absolutely nothing towards its maintenance."

The valley of the Apishapa has an extensive body of excellent land, for which the seasonal flow of the stream is wholly inadequate, all of which can be successfully cultivated if one irrigation could be assured.

#### MONUMENT RESERVOIR.

Situated in El Paso county, on Monument creek, about one mile west of Monument Station, on the D. & R. G. Railroad. The drainage area is about twenty-two square miles, and the claim is located at the confluence of Monument and McShane creeks, where ample spillways were obtainable at each end of the embankment. The earth dam is 855 feet long, 20 feet wide on top, inner slope riprapped 3 to 1, outer slope 2 to 1, maximum height 40 feet, having two 16-inch cast iron outlet pipes; total cost, \$33,121.53, impounding 856 acre-feet of water and covering 62 acres. It was constructed in 1893-1894, under the supervision of State Engineers Maxwell and Cramer. The flood waters enable it to be filled once, and sometimes oftener, each year.

The county commissioners of El Paso county have assumed control of the reservoir, and have expended about \$2,500 in keeping it in repair, and employ a caretaker, whose business it is to watch the floods and turn out the water, when requested, by the water commissioner.

There are no adjudicated water rights to the reservoir, but it is filled and the water impounded is used by the different ranchers without regard to priorities. A lease for ice storage has been made at an annual rental of \$500. No revenue is received from the impounded water.

#### HARDSCRABBLE RESERVOIR.

Situated in Custer county, in a short draw near Hardscrabble creek, about a mile easterly from Wetmore postoffice. The reservoir is filled by a ditch from Hardscrabble creek, the dimensions and length of which are not at hand. It is an earth dam, having a length of 1,285 feet on the crest, 15 feet wide on top,



having an inner slope of 3 to 1, outer slope 2 to 1, with a maximum height of 30 feet; total cost, \$9,997.31, and impounding 102 acre-feet of water and covering 11.7 acres. It was completed in 1894, and was constructed under the supervision of State Engineer Cramer. The ordinary flow of water in Hardscrabble creek is decreed to ditches, so that dependence has to be placed upon flood water for the filling of the reservoir. The county clerk has informed me that "we (Custer county) do not consider ourselves holden for any expense in connection with this reservoir. The benefit accruing from the reservoir being largely to two people, it would be far better to have the reservoir washed out and remain washed out than for the board to undertake its maintenance. The State has taken no steps to fix the water rights and it can not be expected that the county will do so."

I am not informed that any public use is made of the reservoir.

#### CHAFFEE COUNTY RESERVOIR.

Situated in Chaffee county, on the headwaters of the South Arkansas river, about four miles north of Monarch, and near the main range. The catchment basin is only four square miles, but from its close proximity to the range, it is supplied by Lake Fork, which passes through it, and is filled each year. The dam is of earth, and I presume it has general dimensions similar to the other ones; total cost, \$14,654.24, and impounds 205 acre-feet, and was completed in 1894, under the supervision of State Engineer Cramer.

Chaffee county has assumed control of the reservoir and maintained it in good condition, at an annual expense of \$125. The water is used by the ranchers and is discharged from the lake, by orders of the county commissioners, by a watchman who is employed at the reservoir. No water rights have been decreed to the reservoir, but water is stored and used.

#### SAGUACHE RESERVOIR.

Situated near Saguache, Saguache county, in a ravine near the Saguache river, and is filled from the latter stream by a ditch. The dam is of earth, and the dimensions are presumed to be similar to that of other State reservoirs. Total cost, \$30,000, and impounds 954 acre-feet of water, and was completed in 1895, and mostly constructed under the supervision of State Engineer Cramer.

The county clerk states that "there has been practically no expense to the county in maintaining the ditch and reservoir, or in distributing the water, and no revenue therefrom, and the ditch and reservoir are in good repair."

There are no adjudicated rights to the reservoir, and as the entire flood flow of Saguache creek is utilized in the irrigation of native hay meadows, it is but seldom that there is any unappropriated water to fill the reservoir, although it has been partially filled a few times and the water used for irrigation.

The superintendents of irrigation of this division have reported as follows regarding this reservoir:

The State reservoir is absolutely of no benefit to the consumers, which, if properly located, would save thousands of acres of crops each year. Water was turned into it on two occasions, and in a short time it had entirely leaked out, and has proved a futile and expensive failure in the way of an experiment, and is generally viewed with disfavor and regarded as a failure.

It would appear from the reports received from the several counties that while some of these reservoirs are serving the purpose for which they were built, others of them are of but little, if any, benefit to the water users, on account of no available water supply.

As the question of future action by the State regarding these reservoirs is not now under consideration, no recommendations thereof are submitted.

Very respectfully,

T. W. JAYCOX,

State Engineer.

### KANSAS-COLORADO IRRIGATION SUIT.

The Legislature of Kansas, in the year 1901, passed a resolution requesting the Attorney General of that State to institute legal proceedings against the State of Colorado, to restrain our people from diverting water from the natural channel of the Arkansas river, within its borders.

In accordance with this resolution Kansas filed its bill in equity in May, 1901, in the Supreme Court of the United States, that court having exclusive original jurisdiction in such matters. Thereafter the State of Colorado filed a demurrer to this bill upon the general grounds that it did not state facts sufficient to entitle Kansas to any relief in the premises. Upon the hearing of this demurrer the Supreme Court declined to pass upon it at that time, but required the State of Colorado to file its answer to the bill, although allowing it to raise the questions included in the demurrer upon the final hearing.

In August, 1903, Kansas asked leave of the Supreme Court to file an amended bill in equity, which was granted, in which amended bill various irrigation companies diverting water from the Arkansas river were included as parties defendant.

In March, 1904, permission was asked of the Supreme Court by the United States government to be allowed to intervene in the case, and permission was granted. In May, of the same year,

a motion to dismiss was filed by the various irrigation companies, but the court also postponed hearing upon this motion until the final hearing of the case upon its merits. At the same time an order was entered appointing Granville A. Richardson, of Roswell, New Mexico, a commissioner to take the evidence of all parties in the case.

The bill of complaint of Kansas, in brief, alleges that the Arkansas river rises in the Rocky Mountains in this State, and flows in a southeasterly direction for a distance of about two hundred and eighty miles before crossing the boundary into Kansas, and that it then flows in an easterly and southeasterly direction through that State for a distance of about three hundred miles, and then on through Oklahoma, Indian Territory and Arkansas on its way to the sea.

It further alleges that the Arkansas valley through the State of Kansas is a level plain, but a few feet above the normal level of the river, and is from two to twenty-five miles in width, and that back to the foot-hills on either side of the river there are bottom lands which are saturated and sub-irrigated by the underflow from the river, so that when the river has a normal flow the water therefrom spreads out on each side to the foot-hills, and thus thoroughly saturates and moistens the ground to the great benefit of growing crops, trees, etc.

It is further alleged in the bill that in recent years various corporations and citizens of Colorado have diverted water from the Arkansas river in this State, and applied the same to the arid lands within the Arkansas valley in Colorado, and that as a result of this diversion of water, that the stream in Kansas has been so materially diminished as to lower the general water level of the Arkansas valley, approximately three feet, thus injuring the crops, vegetation, etc., growing in said valley.

The State of Kansas in the bill then prays that the citizens and corporations of Colorado be permanently enjoined from diverting any water from the stream in this State.

The answer of Colorado admits that in recent years divers corporations and citizens of this State have, by means of canals and ditches, diverted water from the Arkansas river in Colorado, but alleges that such water has been applied to beneficial uses upon arid lands, and that, as a result of such irrigation, that portion of the State which was once an arid waste, almost uninhabited, has become covered with productive farms and gardens, and supports a large population of energetic and prosperous people. That large towns have grown up, and great industries have been established.

Colorado further contends, in its answer, that the Arkansas river is practically two rivers, one a perennial stream, rising in the mountains of this State and flowing down from the plains into the western part of Kansas, where it spreads out in the



sands, and, except in high water, sinks therein or is lost by evaporation, and the other a river rising in central Kansas, partly from springs, partly from the drainage of the water table of the country supplied by rainfall, and partly from the surface drainage of an extensive territory in Kansas, and flows from there on to the mouth of the river as a new and separate stream, and that each of these rivers has existed in practically the same condition long before irrigation in Colorado.

Colorado in its answer further denies that the water spreads out from the river under the entire Arkansas valley in Kansas, but insists that, on the contrary, the drainage is from the valley into the stream, and that, therefore, the residents of Kansas along said stream have not been materially injured by the use of water in Colorado, but, on the contrary, have been benefited, in that much of the flood waters in Colorado has been stored in reservoirs and then spread upon the land at a time when the water would naturally be very low in the stream, and from seepage and drainage increased the flow of the Arkansas river perennially to the direct benefit of the people in Kansas, in giving them water when they otherwise would have none, and in preventing flood waters in a measure, from destroying property as formerly.

The Government, on the other hand, has intervened in the case, setting up that its rights in building reservoirs and irrigation systems in the arid regions are being jeopardized by both Colorado and Kansas contentions, in that it is necessary, in order to make the government irrigation systems successful, that water be carried from one State to another, and, therefore, in brief, it insists that while the right to divert water from streams for beneficial uses should be acknowledged, that State lines should not be recognized, but that the prior appropriator anywhere upon the stream should have his rights protected, regardless of State lines.

More than three hundred witnesses, including many experts in irrigation and geological matters, have been examined; this evidence amounting to something like thirty-three thousand folios was abstracted and condensed for the benefit of the court upon the final hearing.

The case was set for oral argument and argued, beginning on the 17th day of December, 1906, and is now submitted to the court for final determination.

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## APPEALS.

In the matter of the appeal of Mr. D. J. McCanne, of the McCanne Ditch and Reservoir Co., filed June 1, 1906, from the decision of Wm. Rist, irrigation division engineer of division No. 1, and C. M. Jump, water commissioner of district No. 2, who proposed to order the water running in the McCanne ditch to be

turned back into the South Platte river, claiming that the ditch was not at that time entitled to any water.

"Denver, Colorado, May 29, 1906.

"Mr. D. J. McCanne, President of The McCanne Ditch and Reservoir Co., Denver, Colorado.

"Dear Sir—I beg leave to acknowledge receipt of a complaint of The McCanne Ditch and Reservoir Company against the proposed action of Mr. C. M. Jump, water commissioner of district No. 2, expressed in his notice to you as follows:

"Denver, Colorado, May 24, 1906.

"Mr. D. J. McCanne, Denver, Colorado.

"Dear Sir—This is to notify you that you are not entitled to any water in The McCanne ditch at the present stage of the river. I shall, therefore, order same closed until there is enough water in river to supply its appropriation.

"Very truly yours,

"(Signed) C. M. JUMP,

"Water Commissioner, District No. 2."

"You request that a time be set for hearing in this matter. I will respectfully state I do not understand that I am authorized to set a date and hold a formal hearing in such matters.

"I have already heard the statements and arguments of yourself and your attorney, Hon. Charles D. Hayt, and must decline to set a date for a hearing. I have made an examination of your ditch and its source of water supply, which is from sloughs on the river bottom lands and from waste waters, as well as from seepage, and believe the conditions will justify the proposed action by the water commissioner.

"After an investigation of this matter, I must sustain the action of the water commissioner.

"Very respectfully yours,

"(Signed) WM. RIST,

"Division Engineer, Irrigation Division No. 1."

"June 26, 1906.

"D. J. McCanne, Esq., President McCanne Ditch and Reservoir Company, Denver, Colorado.

"Dear Sir—In the matter of an appeal brought by the owners of the McCanne ditch before the State Engineer from the decision of the irrigation division engineer of division No. 1, sustaining the proposed action of the water commissioner of district No. 2, in diverting the entire flow of water in said ditch from its channel at a place near the crossing of the Boulder branch of the Union Pacific Railroad.

"The proposed action of the water commissioner was based upon his belief that the McCanne ditch was not at that time



entitled to water from the South Platte river due to its priority of appropriation, and that it could not legally obtain water from any other source, and therefore the water which was running therein should be returned to the river.

"A personal examination of the McCanne ditch was made June 6, 1906, accompanied by Messrs. Hayt, Jump and McCanne, for the purpose of observing the source of its water supply.

"The McCanne ditch has a headgate on the right bank of the South Platte river in the W.  $\frac{1}{2}$  of Sec. 12, T. 1 S., R. 67 W., and runs thence in a general northerly direction to Sec. 17, T. 1 N., R. 66 W., and has a priority date of April 2, 1895, for 40 cubic feet of water per second of time. Water can not be diverted from the South Platte river, as the portion of the ditch near the river has not been maintained in repair for a number of years.

"An extension of this ditch was made by the construction of a ditch running southward from the N. E.  $\frac{1}{4}$  Sec. 12, T. 1 S., R. 67 W., following generally the edge of the bottom lands nearest the first bench and passing through and adopting for a portion of its length, the existing natural sloughs in Sec. 12, T. 1 S., R. 67 W., while across the lands in Secs. 13 and 24, T. 1 S., R. 67 W., an open ditch was dug.

"This open ditch was made for the purpose of draining these bottom lands, under agreement with the owners thereof, that the compensation for the benefits to be derived from drainage, should be the water thus reclaimed, the owners of the land bearing no portion of the expense of construction.

"That portion of the ditch in the N. E.  $\frac{1}{4}$  Sec. 12, and the S. E.  $\frac{1}{4}$  Sec. 1, T. 1 S., R. 67 W., was built for the additional purpose of draining lands owned by some of the owners of the McCanne ditch.

"These lowlands were fertile farming lands and had been cultivated and crops of grain, grass, etc., grown thereon for a long term of years previous to the construction of these drain ditches, while for a relatively short period of time, before their building, the ground had been rendered unfit for use for tillable crops by reason of the saturated condition of the soil, converting a large portion of it into swamp.

"This soil condition was stated to me, by many disinterested competent persons, to be wholly due and caused by percolating waters arising from irrigation upon the adjacent uplands, and that it did not occur until after the construction of the Fulton ditch and irrigation therefrom of lands lying thereunder.

"The question has been presented as to waste water and slough waters which are collected and conveyed by the McCanne ditch.

"In my opinion, if the waste water is caused by an excessive diversion from the Fulton ditch, or the wasteful application of the water to the land so as to form a surface stream, it should be

returned to the river, but if caused by ordinary irrigation methods, the stream being formed by percolating waters, rising to the surface, it is subject to appropriation as seepage water.

"As to the water from the sloughs, which form a part of and flow into the McCanne ditch, the claim is made that these sloughs are natural streams and tributaries of the river and the water can not be diverted as against the rights of prior appropriators.

"To sustain this claim would require that a surface or underground flow from the head of the slough all the way to the river should be shown to have existed at the time the McCanne ditch was built, which claim was contradicted, as to surface flow, by several people in conversation with me.

"As the determination of this contention would require a closer examination than can be given to it by me at this time, it will be held that the water from the sloughs should be turned out of the ditch at the places where it formerly emptied into the river.

"It is my opinion that the owners of the McCanne ditch have proceeded under the provisions of the State law in regard to the construction of a ditch for the purpose of utilizing the waste, seepage and spring waters of the State, and have a legal right to the use of the water obtained by the drainage of these lands.

"The water thus obtained being percolating or seepage water, existing in the earth, belonging to the soil, as a part of the realty, may be used and controlled to the same extent by the owners of the land, which has been done in this case by contract by the said land owners with the McCanne ditch company.

"Upon the construction of suitable measuring flumes at such places as will determine the flow of said ditch, one at or near the outlet of the last slough in the S.  $\frac{1}{2}$  N. E.  $\frac{1}{4}$  Sec. 12, T. 1 S., R. 67 W., and the other near the north line of Sec. 13, T. 1 S., R. 67 W., measurements will be made of the amount of water this ditch is entitled to, by reason of the construction thereof, and the same amount will be allowed to flow therein from the measuring flume in the N. E.  $\frac{1}{4}$  Sec. 12, and the surplus water in said ditch, at this point, if any there be, will be returned to the river.

"The decision of the irrigation division engineer and water commissioner is hereby modified and orders will be issued in accordance with this opinion.

"It is suggested that immediate action be taken in the proper District Court for the adjudication of the right to the use of the water of this ditch.

"Yours very truly,

"(Signed) T. W. JAYCOX,  
"State Engineer."

In accordance with a request from this office two measuring flumes were placed in the ditch at points designated. No action has yet been taken in the courts to finally determine this controversy.

On June 1, 1906, Mr. Joseph Cykler appealed to this office from the decision of Mr. Wm. Rist, irrigation division engineer, Division No. 1 and Mr. John W. McLean, water commissioner District No. 9, in the matter of allowing 80 inches of water of priorities No. 7 and No. 20 adjudicated to the Hindry ditch to be conveyed therein or the same quantity of water to be transferred to the Ward and Kendrick ditch. In letter of May 10, 1906, from Mr. Cykler to Mr. Rist, a request was made to have 80 inches of water which was claimed as part of priorities No. 7 and No. 20, adjudicated to the Hindry ditch, to be allowed to use the water in the Ward and Kendrick ditch "in order to obtain the above amount upon my land when needed and to which I am entitled by virtue of the decrees above mentioned."

Under date of May 14, 1906, Mr. Rist replied that "from the investigation I have made I believe the action which you wish to secure would be a transfer, and must be determined by the courts; also, that if you are entitled to have the additional amount of water turned into the Ward ditch, you should have the court's order for the same."

Under date of May 19, 1906, Mr. Cykler addressed Mr. McLean, demanding that he "be furnished with 80 inches of water in the Hindry ditch in addition to the 100 inches of water he was now receiving through the Ward and Kendrick ditch."

Under date of May 28, 1906, Mr. McLean refused the request of Mr. Cykler, claiming that he had no right to any further water from the Hindry ditch, "as to my certain knowledge none of it had been used for a long term of years."

Upon application of the Harriman Ditch Company a hearing was set at the office of the State Engineer on July 27, 1906, when a number of witnesses were examined, evidence was heard and argument of counsel was had.

Mr. Joseph Cykler,

Denver, Colorado.

Dear Sir—In the matter of your application to the water commissioner and irrigation division engineer for the use of eighty inches of water from Bear creek, water district No. 9, by virtue of decrees Nos. 7 and 20, to the Hindry ditch:

Your request to the irrigation division engineer was "to be allowed to use the water in the Ward and Kendrick ditch," and was disallowed by him upon the ground that the "action which you wished to secure would be a transfer and must be determined by the courts," in which conclusion I concur, and am of opinion that recent decisions of the Supreme Court of



this State leave no doubt that the transfer of the point of diversion of any water right from the place originally designated in the decree has to be done by a proceeding in the District Court.

Your request to the water commissioner was "why I cannot have my demand complied with that I be furnished with eighty inches of water in the Hindry ditch in addition to the one hundred inches of water I am now receiving in the Ward and Kendrick ditch" was not complied with by him, stating as a reason therefor, "as water commissioner I cannot recognize a right to the use of water which has not been used for a period of more than seven years to my certain knowledge." Upon a protest by the Harriman Ditch Company, duly filed in this office, against the opening of the Hindry ditch, a hearing was had before the State Engineer, where evidence and arguments of counsel were heard regarding this controversy.

The evidence supported the following statements, to wit:

That the Hindry ditch was used to convey water to irrigate about sixty acres of land until early in the year 1897, when a high stage of water in Bear creek caused the destruction of the headgate and washed away a considerable length of the ditch adjoining the creek and also nearly across a forty-acre tract of land.

That this tract of land upon which the Hindry ditch was situated was plowed up and cultivated during succeeding years with the knowledge and without protest by the claimant of this water right, and this unusable condition of the ditch prevailed until July, 1906, when the headgate was replaced and the ditch was reconstructed.

That Mr. Cykler made demands of the water commissioner for the diversion of this water prior to the rebuilding of this portion of the ditch.

This question appears to me to be one of non-user of a water right. It is well settled in this State by the highest judicial authority that the right to the use of water is based upon its actual diversion and its application to a beneficial use, also that the continuance of the right depends upon the continuous use of the water, and hence may be abandoned by non-user.

Between the years 1897 and 1906, while the Hindry ditch was partially destroyed and not in a condition to convey water, a demand made upon the irrigation officials for the use of this water through this ditch could not be complied with, and allowing the ditch to remain in this condition for ten irrigation seasons may fairly be assumed to create a presumption of intention to abandon it, and a failure to use the water that has once been applied to the land is competent evidence on the question of abandonment, particularly if such non-user be continued for such a period of time as to be considered of unreasonable length.

It is a difficult matter in any particular case to determine whether or not a water right has been abandoned, or whether the acts of the owner of the water right, under the circumstances thereof, constitute an abandonment.

I am of opinion that the evidence submitted in this case is sufficient to support the contention that the term of non-user of this water right, as to the eighty inches thereof, has been for an unreasonable time, and the presumption of the intention to abandon it is strong enough to justify the maintenance of the present method of distributing the waters of Bear creek, and therefore the decision of the water commissioner in reference thereto is hereby sustained.

Respectfully,

(Signed) T. W. JAYCOX,

State Engineer.

On August 17, 1906, an appeal was made by Mr. Thomas M. Moore from the decision of Mr. A. H. Stokes, irrigation division engineer, division No. 4, in the matter of allowing a transfer of 85 inches of water from the Eggleston ditch to the Montrose and Delta canal in district No. 41. This request was refused by the irrigation division engineer, who stated that "you recently petitioned the district court to make a change of point of diversion of the water which you own from the Eggleston ditch to the Montrose and Delta canal, and as the judge of that court refused to allow the change, it seems to me that the commissioner of the district is right to refuse to deliver your water into any but the ditch to which it was decreed."

The decision of the irrigation division engineer was affirmed upon the grounds stated in his decision, and also because an appeal had been taken to the Supreme Court and was pending therein.

On September 2, 1906, Mr. George Hider, water commissioner, district No. 40, appealed from the order of Mr. A. H. Stokes, irrigation division engineer, division No. 4, in the matter of changing the point of diversion of the Hotchkiss ditch, decree No. 3, to the Peterson, Carr and Barrow ditch, decree No. 6.

On September 5, 1906, Mr. Stokes made the following statements:

"I have had frequent discussions with Mr. Hider as to the change of point of diversion which he and others before me seem to have allowed, including the one mentioned, and have recently had the question come squarely to me. The facts are these: Under the decree of 1889, the Hotchkiss ditch was decreed priority No. 3 (1.7) feet absolutely. In 1892 certain owners wished to make a change of point of diversion of this water and petitioned the court to make the change.



"It seems that Mr. Hider made up his mind to make a radical change this fall and refuse all changes not decreed by the court, and when I gave a ruling I sent him the following order:

"The water of Leroux creek should be distributed strictly according to decree, both as to amount and place of diversion, given by the district court of Delta county, the same being modified by the order of court to be found in Record No. 1, page 308. Said order was given in proceedings under a petition by the owners of the Hotchkiss ditch to change their point of diversion to the Peterson, Carr and Barrow ditch, and it does not appear that any proceedings have taken place in the court to either extend or modify the court's holding. The original decree must therefore be held, modified to the extent of allowing the water decreed to the Hotchkiss ditch to be diverted into the Peterson, Carr and Barrow ditch."

"My recognition of the proceedings in court in 1892 as being a legal change of diversion, or at any rate one which an official should recognize, is based on the fact that there was no statutory method of changing a point of diversion at that date. There is no question that the owners wished to submit the question to the court, and the court did for them all it felt it could in the absence of statutory instructions. It is not parallel, in my opinion, to cases in which no attempt was made to have the district court pass on the change, and I read the ruling as being one which (however defective it may be) squarely puts the burden of proof of injury on those injured (as it always is) and leaves it to them to start suit. No questions of fact as to injury, past or present, non-user, etc., influence my decision; it is based practically on the court order in 1892. This I hold to be good enough for an official."

"Sept. 13th, 1906.

"Mr. Arthur H. Stokes,

"Irrigation Division Engineer,

"Division No. 4,

"Grand Junction, Colo.

"Dear Sir:—In the matter of the appeal of Water Commissioner of Water District No. 40 from the order of Mr. A. H. Stokes, Irrigation Division Engineer, in reference to the change of the point of diversion of the Hotchkiss Ditch, Priority No. 3, to the Peterson, Carr and Barrow Ditch, Priority No. 6, on Leroux Creek, Delta County, Colorado.

"The order of the Irrigation Division Engineer was as follows:

"The water of Leroux Creek should be distributed strictly according to decree, both as to amount and place of diversion, as given by the District Court of Delta County, the same being

modified by the order of Court to be found in Record No. 1, page 308. Said order was given in proceedings under petition by the owners of the Hotchkiss Ditch, to change their point of diversion to the Peterson, Carr and Barrow ditch, and it does not appear that any proceedings have taken place in the Court to either extend or modify the Court's holding. The original decree must therefore be held modified to the extent of allowing the water decreed to the Hotchkiss Ditch to be diverted into the Peterson, Carr and Barrow Ditch."

"The order of the Irrigation Division Engineer is based solely on the opinion of the Hon. Judge of the District Court of Delta County, in a proceeding based on the petition of E. T. Hotchkiss, et al., to have the point of diversion of the water decreed to the Hotchkiss Ditch from Leroux Creek changed to the Peterson, Carr and Barrow ditch, taking water from the same stream.

"This petition was filed in said Court on Feb. 1st, 1892, and the opinion was rendered Feb. 17th, 1892, and is as follows:

"Upon the application of the petitioner to change the point of diversion of the Hotchkiss and Irving Ditch, and upon due consideration thereof, the Court holds as a matter of law, that the claimant has the right to change his point of diversion whenever he sees fit, so that he does not injuriously affect the rights of others."

"It is not questioned that the opinion of the Court, as a matter of law is correct, but the Court did not enter any order in reference to changing the point of diversion of the Hotchkiss ditch as prayed for by the petitioners, simply stated that they had a right so to do, thus leaving the status of the decree to the Hotchkiss Ditch as it was in its original decree.

"The Supreme Court has stated, that the fact that a change was made in the point of diversion prior to the date when the Act of 1899 and the Act of 1903 on the same subject (Laws 1899, 235, and Laws 1903, 278) took effect, did not render the right to such change a vested one.

"Prior to these Acts there was no statute on the subject, and while the courts have recognized that the owner of a priority could change the point of diversion, it was always with the limitation that such change did not injuriously affect the rights of others.

"Until determined in some appropriate proceeding, the question of whether or not a change in the point of diversion injuriously affects others is left open for determination at the instance of any one claiming to be injuriously affected by such change.

"The statutes in question are not designed and do not have the effect of divesting any one of a right to such change, whether made before or after the law took effect, but are only intended

to have such rights determined in a way which shall bind all parties affected by the change, and thus have evidenced in the form of a decree, the right of a claimant to a change in the point of diversion, whether exercised before the law took effect or to be enjoyed in the future.

"A change in the point of diversion can be done only in proceedings under the Acts so providing, in the appropriate court, where all persons affected by such change are duly notified of the proceedings, and given the opportunity to be heard, and not until it appears that their rights are not injuriously affected, before the court is authorized to enter an order allowing such change.

"This question appears to be solely a matter of law in relation to changing the point of diversion of the right to use water from the streams of the State, and while a proceeding in court was had in which an attempt was made, having for its object the change of the point of diversion of the Hotchkiss ditch, the court failed to enter any order in reference to such change, and as objections have been made to changing the point of diversion of the waters decreed to the Hotchkiss ditch, and as the original decree has not yet been changed by any judicial proceeding, I am of the opinion that the owners thereof should comply with the Acts of 1899 and 1903 in reference to changing the point of diversion of a water right by proceedings in the proper court so that it may be authoritatively settled by judicial determination.

"The order of the Irrigation Division Engineer is revoked and the Water Commissioner is hereby ordered to distribute the waters of Leroux creek strictly in accordance with the decrees of the respective ditches until such time as the District Court shall change or modify such decrees.

Yours very truly,

(Signed)

T. W. JAYCOX,  
State Engineer."

## FILINGS ON THE RIO GRANDE RIVER WATER SHED IN COLORADO.

On December 5, 1896, an order was issued by the Department of the Interior withdrawing all government lands lying in the Rio Grande river water shed in the State of Colorado from use as reservoir sites or canal right of ways. This order was issued to comply with the terms of an old treaty with the Republic of Mexico relative to the waters of the Rio Grande river.

This order was in force until May 25, 1906, when a new order was issued. The United States government had negotiated a new treaty with Mexico. The new order accepted for filing for right of way over government lands all irrigation projects which were initiated prior to March 1, 1903.

On September 27, 1906, the order relative to filings on reservoirs was again modified upon the application of Hon. C. C. Holbrook on behalf of the people of the San Luis valley. In effect, this order refers each filing to the director of the United States Geological Survey for a report before acceptance by the Department of the Interior. If, in the opinion of the chief engineer of the United States Reclamation Service, the proposed reservoir will not interfere with the government's reclamation project in New Mexico, the filing is favorably reported upon.

Since the last order was issued, the reservoir filing of A. R. Smith et al., on the Conejos river, which had been rejected under an old order, has been accepted. We are creditably informed that other filings have been approved.

## GUNNISON TUNNEL.

Work by the United States Reclamation Service on the Gunnison tunnel of the Uncompahgre valley project is progressing rapidly under the direction of the U. S. Reclamation Service engineers.

The total length of the tunnel is 30,581.9 feet. Some 17,400 feet have been bored, and the work of lining the tunnel with concrete has begun.

On November 27, 1905, the U. S. Reclamation Service made filings in this office on the waters of Gunnison river, which complied with the laws of Colorado with respect to filing claims to water.

## CO-OPERATION WITH THE UNITED STATES.

During the past years, the United States, through the Department of the Interior, U. S. Geological Survey, have selected



and maintained a large number of gauging stations on the main and tributary streams of the State, and furnished the State Engineer with the discharge tables of stream flow at these stations and frequently without material financial assistance from the State.

These tables have been furnished by the U. S. Geological Survey and published in the biennial reports, and are of exceeding value in matters pertaining to irrigation, water power and water supply for beneficial purposes.

This State has received almost untold benefits from the work of the U. S. Geological Survey in the matter of making geological and hydrographical surveys, and at this time, when the appropriations of the general government for the use of the hydrographic branch of this survey have been greatly decreased, it is opportune for the State to provide by appropriation sufficient funds to continue the work and thus obtain an unbroken line of observation, which are of great advantage, as the longer the time, the more valuable do the data become.

I take pleasure in presenting herewith a recent letter from the Director of the U. S. Geological Survey, the Hon. Charles D. Walcott, and would request a careful consideration of the statements therein.

“Washington, D. C., December 15, 1906.

“Mr. T. W. Jaycox, State Engineer, Denver, Colorado:

“Sir—In reply to your letter of December 1:

“Argument for co-operation between the State and the United States Geological Survey in investigations of water resources can be made on the following lines:

“Surface waters of the State have great value for irrigation, water power and public water supply; and ground waters are of value for irrigation and water supply. There is manifest, therefore, the great importance of securing reliable information in regard to the quantities of waters available at all seasons for such purposes, and of making measurements of the slopes of the streams, and of determining the location of available sites for power development.

“These data, if available, will be of great value in the industrial development of the State and in the present and future distribution of the waters among the many users. They can be collected only by observations and measurements extending over considerable time, and on very many streams.

“The cost of collecting such data is great. Funds available from appropriations to the United States Geological Survey are not sufficient to undertake the collection of all of them in the near future. Neither does the State appropriate sufficient money for this work. By a combination of the two funds, however, and by utilizing the trained engineers and hydrographers in the employ

of the State and United States Geological Survey, and by co-operation between the two organizations, much more can be accomplished than is possible by either party or by both working independently.

Very respectfully,

“CHARLES D. WALCOTT,

“Director.”

The following is a list of gauging stations maintained by the U. S. Geological Survey during the years 1905-1906. These stations are well selected. The value of the data already collected will increase with the addition of other data gathered as time goes by.

*Platte River Drainage Basin—*

*North Platte River—*

Big Grizzly creek, at Hebron, Colo.  
Little Grizzly creek, at Hebron, Colo.  
Roaring Fork of North Platte river, near Hebron, Colo.  
North Fork of North Platte river, at Higho, Colo.  
North Platte river, near Hebron, Colo.  
North Platte river, near Cowdrey, Colo.  
Canadian river, at Cowdrey, Colo.  
Michigan creek, near Walden, Colo.  
Michigan creek, near Cowdrey, Colo.  
Laramie river, at Glendevey, Colo.  
McIntyre creek, at Gleneyre, Colo.

*South Platte River—*

South Platte, at South Platte, Colo.  
South Fork of South Platte, at South Platte, Colo.  
South Platte, at Denver, Colo.  
South Platte, near Kersey, Colo.  
South Platte, near Julesburg, Colo.  
Clear creek, at Forkscreek, Colo.  
Miscellaneous measurements.

*Arkansas River Drainage Basin—*

Arkansas river, near Canyon, Colo.  
Arkansas river, at Pueblo, Colo.

*Purgatoire River Drainage Basin—*

Purgatoire river, at Trinidad, Colo.  
Purgatoire river, near Alfalfa, Colo.

*Rio Grande Drainage Basin—*

Rio Grande river, near Del Norte, Colo.  
Rio Grande river, near Lobatos, Colo.  
Conejos river, near Mogote, Colo.



Concrete Outlet Culverts, Julesburg Reservoir, Sedgwick County.



Slope Paving, Julesburg Reservoir, Sedgwick County.





*Yampa River Drainage Basin—*

Yampa river, at Steamboat Springs, Colo.  
Yampa river, near Craig, Colo.  
Yampa river, near Maybell, Colo.  
Elk River, near Trull, Colo.  
Elkhead creek, near Craig, Colo.  
Fortification creek, at Craig, Colo.  
Williams river, at Hamilton, Colo.  
Milk creek, near Axial, Colo.  
Miscellaneous measurements.

*White River Drainage Basin—*

North Fork of White river, near Buford, Colo.  
South Fork of White river, near Buford, Colo.  
White river, at Meeker, Colo.  
White river, near Rangely, Colo.  
Marvine creek, near Buford, Colo.

*Grand River Drainage Basin—**Grand River—*

North Fork of Grand river, near Grand Lake, Colo.  
Grand lake outlet, at Grand Lake, Colo.  
North inlet to Grand lake, at Grand Lake, Colo.  
Grand river, near Lehman, Colo.  
Grand river, at Hot Sulphur Springs, Colo.  
Grand river, near Kremmling, Colo.  
Grand river, at State Bridge, near Wolcott, Colo.  
Grand river, at Glenwood Springs, Colo.  
Grand river, near Palisades, Colo.  
Miscellaneous measurements.

*Fraser River Drainage Basin—*

Fraser river, at Granby, Colo.

*Williams Fork Drainage Basin—*

Williams Fork, near Hot Sulphur Springs, Colo.

*Troublesome River Drainage Basin—*

Troublesome river, at Troublesome, Colo.

*Muddy River Drainage Basin—*

Muddy river, at Kremmling, Colo.

*Blue River Drainage Basin—*

Blue river, near Kremmling, Colo.

*Eagle River Drainage Basin—*

Eagle river, near Eagle, Colo.

*Gunnison River Drainage Basin—*

Roaring Fork (of North Platte), near Glenwood Springs,  
Colo.

East river, at Almont, Colo.

Taylor river, near Almont, Colo.

Gunnison river, near Cimarron, Colo.

Gunnison river, at east portal of Gunnison tunnel, Colo.

Gunnison river, near Cory, Colo.

Gunnison river, at Whitewater, Colo.

North Fork of Gunnison river, near Hotchkiss, Colo.

Cimarron creek, at Cimarron, Colo.

Uncompalgre river, near Colona, Colo.

Uncompalgre river, at Montrose, Colo.

Uncompalgre river, at Delta, Colo.

Miscellaneous measurements.

*Colorado River Drainage Basin—**San Juan River Drainage Basin—*

Animas river, at Durango, Colo.

La Plata river, at Hesperus, Colo.

Miscellaneous measurements.

The appropriation allotted for this work by the federal government has been materially decreased, and if the work is to be continued our State should make appropriations sufficiently large to enable this department to co-operate with the hydrographic branch of the Geological Survey. The data collected is of great value to prospective investors in our water resources:

The Department of Agriculture, office of experiment stations, through the bureau of irrigation and drainage investigations, has had under consideration for a number of years the examination of every phase of irrigation matters and has devoted a large amount of effort in this State as to the best method for the utilization of irrigation waters in agriculture, plans for the removal of seepage and surplus waters by drainage, the use of different kinds of power for pumping, the examination of localities for underground supplies of water, the duty of water at various places with different soils and varieties of crops using variable amounts of water, with a study of the methods of applying the waters; the loss of water carried in ditches and canals by measurement of quantity at several places along their length, together with a study of the laws controlling the use and distribution of water.

The result of these studies and examinations have been published and are to be found in the bulletins of the office of experiment stations, which can be obtained from the Secretary of Agriculture, Washington, D. C., or by application to a member of Congress.

I have the pleasure of including an article prepared by the Hon. Elwood Mead, chief of irrigation and drainage investigations, upon the work recently done by this branch in the State of Colorado:

## THE ADVANTAGES OF CO-OPERATION IN IRRIGATION AND DRAINAGE BETWEEN THE UNITED STATES OFFICE OF EXPERIMENT STATIONS AND THE STATE ENGINEER'S OFFICE OF COLORADO.

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BY ELWOOD MEAD, CHIEF OF IRRIGATION AND DRAINAGE INVESTIGATIONS.

Every irrigation official is repeatedly asked for advice or an opinion as to the duty of water. Men wish to know what it is and what it may be. The value of large projects often depends on the acres which an inch of water will serve or the acre-feet of stored water needed for an acre of land. Hence, the State irrigation department needs new and reliable data as a basis for official action and to promote development.

The United State office of experiment stations has done much work along these lines during the past two years at Rocky Ford and Loveland. The purpose was to determine how much water should be used in irrigating sugar beets, and with this to ascertain how the water should be applied and the soil cultivated to lessen the evaporation losses and increase the duty of water.

During the first year twelve plots, of one-fifth acre each, at each place were planted to beets in such a manner that the rows crossed land plowed 6 inches, 8 inches and 10 inches deep, and water was applied across the strips of land plowed as above described.

The experiments included particularly method of application. On the experiment plots, the water was applied to each furrow by means of small lath boxes placed in the ditch banks and permitting a small amount to flow for a long period down each furrow. On the general fields the ordinary furrow method of dividing the stream by cutting ditch banks at each furrow was used. The results showed that with the former practice about 30 per cent. less water was used in each irrigation and better results obtained than in the latter mode.

During the season of 1905 it became manifest that thorough tillage of sugar beets is a very important item; to determine its full influence, much more elaborate experiments were carried on in 1906. In these latter experiments the range in the depth of water applied has been made still wider than in 1905.

We know that frequent cultivation lessens evaporation and reduces the amount of water furnished by irrigation. We have sought here to find out the limit to which the plow can take the place of the ditch. The records of the moisture in the soil and the yield of the crop in beets and sugar will help to show how much farther better practice will extend irrigation.

Parallel with these experiments the water used by good farmers in each community was measured and their methods of tillage has been carefully watched.

The results of 1906 are not yet available, but this much is known: More water is being used than is necessary. The duty of water may be increased by changing the usual method of irrigation by thorough tillage.

In 1905 it developed that in ordinary practice approximately three acre-feet of water per acre was used to irrigate sugar beets. This was the average amount of water placed upon the land, not including any losses from seepage from main canals. Areas receiving  $10\frac{1}{2}$  inches of water during the same period and well cultivated after the first irrigation; again, areas receiving 20 inches of water and well cultivated yielded upwards of 30 per cent. more than those receiving 23 inches of water without thorough cultivation. The season of 1905 was exceptional in the amount of precipitation during the growing season, the rainfall for this period being about one-third above the normal. In a season of ordinary rainfall much greater contrast would be probable.

Following is the summary of the results at Rocky Ford and Loveland in 1905. Those numbered 1, 2, 3 and 4 in each case are experimental plots, irrigated and cultivated under the direction of this office, whereas those marked G-1, G-2 and G-3 are general fields farmed by good farmers without any direction from this office:



## DUTY OF WATER MEASUREMENTS AT ROCKY FORD, COLO.

PLOT	DEPTH OF WATER APPLIED	YIELD PER ACRE
	Inches	Pounds
1. ....	10.5	17,250
2. ....	11.5	19,408
3. ....	17.7	21,130
4. ....	19.8	23,237
G-1*.....	12.0	17,643
G-2*.....	22.9	17,036

## DUTY OF WATER MEASUREMENTS AT LOVELAND, COLO.

1. ....	5.4	27,850
2. ....	15.0	33,735
3. ....	16.4	33,560
4. ....	25.4	35,765
G-3*.....	34.5	27,966

\*Not cultivated after first irrigation.

## IRRIGATION OF ORCHARDS.

Near Canon City the right method of irrigating apple orchards is being investigated, in co-operation with the Lincoln Park Land & Irrigation Company, on the south side of the Arkansas river, and with Hon. B. F. Rockefeller on the north side. Experiments are also being conducted in co-operation with Mr. W. B. Rowland, of Lincoln Park; the object is to determine the effect of abundant or scanty use of water upon the quantity and quality of fruit. These experiments also include investigations of the influence of tillage on the amount of water used in irrigation. In one case about five acre-feet of water was used, while in another over an area of more than 900 acres the average depth of water applied was 77 inches. The experiments of 1906 will demonstrate what can be done by using about one-third this amount of water, when combined with thorough tillage.

## IRRIGATION EXTENSION IN EASTERN COLORADO.

The large number of settlers coming into eastern Colorado, where the limited rainfall makes agriculture without irrigation somewhat hazardous, has led this office to give its aid to extending irrigation in this section by working out and demonstrating the methods of utilizing limited water supplies.

The depth to ground water in this section showed that much can be done by pumping. The following table shows the lift required at various places investigated this year:

## DEPTH TO GROUND WATER IN EASTERN COLORADO.

LOCAT ON	COUNTY	DEPTH TO WATER
		Feet
Bovina.....	Lincoln.....	115
Hugo.....	Lincoln.....	45
Arriba.....	Lincoln.....	65
Arroya.....	Cheyenne.....	14
Wild Horse.....	Cheyenne.....	11
Sheridan Lake.....	Kiowa.....	84
Chivington.....	Kiowa.....	33
Eads.....	Kiowa.....	65-70
Arlington.....	Kiowa.....	17
Vilas.....	Baca.....	50-65
Monon.....	Baca.....	15-20
Holly.....	Prowers.....	10-15
Flagler.....	Kit Carson.....	5-20
Siebert.....	Kit Carson.....	15-25
Burlington.....	Kit Carson.....	185
Cope.....	Washington.....	18
Akron.....	Washington.....	20-120
Otis.....	Washington.....	220
Wray.....	Yuma.....	80
Brush.....	Morgan.....	14-45
Sterling.....	Logan.....	18
Grover.....	Weld.....	18
Dover.....	Weld.....	40
Munn.....	Weld.....	28
Ault.....	Weld.....	34

An irrigation extension farm has been established at Eads, in co-operation with the Missouri Pacific and local organizations, to illustrate and determine the cost and value of irrigation from wells in this section; investigations are being made to ascertain the amount and character of other available water supplies for irrigation in this region, especially the flood waters, which now run to waste or are lost in evaporation and seepage, but which may be made available either through storage or through flood-water irrigation.

At Eads the performance and efficiency of various types of pumps and engines will be tested and the results given to those who visit the farm or apply for our bulletins.

The question of flood water irrigation, which has been utilized effectively in other places, and which promises much in Colorado, will be thoroughly tried.

## DRAINAGE INVESTIGATIONS AND SURVEYS IN THE SAN LUIS VALLEY.

For a number of years the seepage water from the ditches and irrigated land of the San Luis valley has constantly extended the acreage injured by water and alkali. Upwards of 300 square miles have been badly affected, a large portion of which formerly produced good crops. This is particularly true of what is termed the "41 district," the heart of which lies some eight miles west from the town of Hooper. In the lower-lying lands of this district farms which yielded 50 to 60 bushels of wheat per acre have become alkalied and returned to chico. This country, once the center of agricultural activity, is now dotted with deserted farm homes, schools and stores. That the quality of the soil, with the alkali removed, is good, is shown by the fine crops raised on the land at an earlier period, and by the further fact that the land along the edge of the affected district and isolated spots of a higher elevation within the district are at present growing good crops, because of the natural drainage.

A preliminary examination made in 1906 shows that in each case the appearance of alkali is simultaneous with the saturation of the soil from the ground water, and that proper drainage would reclaim the alkalied lands and return them to their former state of productiveness.

The fattening of lambs and hogs by feeding field peas has become a very important industry in the San Luis valley and promises to assume much larger proportions in the future. Last year upwards of one-half million lambs were fattened for market in this vicinity.

Land that will yield a fair crop of field peas or grain is at present worth \$50 to \$100 per acre. From this it is fair to assume that the project of draining the San Luis valley is excellent from a financial point of view, both for the land owner and the State. The three factors largely responsible for the presence of alkali are: (1) Seepage from canals and laterals; (2) subirrigation, and (3) artesian wells.

Seepage—The seepage from the canals and laterals is in many cases abnormal and keeps the lower-lying and marginal land in a more or less saturated condition. No effort has so far been made to rectify this evil.

Subirrigation—Unfortunately, this method of irrigation has been practiced throughout the valley, with few exceptions, for upwards of twenty years, because of the additional cost of surface methods of applying water, and because of the scarcity of water at critical periods. This method is extremely detrimental to the land and has been made more than any other one factor instrumental in bringing about the present alkali conditions.

**Artesian Wells**—The San Luis valley is underlaid to a large extent with artesian water at moderate depths. Throughout those portions that have at one time or another been under cultivation artesian wells have been bored at the rate of approximately one well per quarter section. These wells flow copiously and are allowed to remain open for the major portion of the year, resulting in the water-logging of a large area and the accompanying appearance of alkali below. Although a law exists providing that all wells be capped and under control, there seems to be no one in whom authority is vested to enforce it.

The reclamation of the San Luis valley is a work of such magnitude that comprehensive plans must be made and executed before owners of farms can secure benefit from individual efforts in farm drainage. It is not a subject requiring experiment in a small way, but one needing plans for large ditches properly located and constructed. The investigations of this office have proceeded far enough to indicate that the reclamation of this valley should be taken up in a more energetic manner and on a larger scale than has heretofore been attempted. No great physical obstacles stand in the way. All that is needed is united effort by the land owners, the State and the federal government.

Co-operation is, therefore, suggested between the State, through its State Engineer, and the federal government, through the United States irrigation and drainage investigations, for which purpose \$5,000 should be appropriated by the State, provided an equal sum be furnished by the irrigation and drainage investigations, the two to form a co-operative fund of \$10,000, with which to make surveys and plans for drainage in the San Luis valley."

I fully concur in the advantages to be gained by the State in a hearty co-operation with the irrigation divisions of the general government, and would recommend that the Legislature should make appropriations sufficiently large to enable this department to co-operate with the U. S. Geological Survey, and the office of experiment stations in carrying out the examinations and work of these departments.

## COUNTY BOUNDARIES.

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### BOUNDARY LINE BETWEEN SAN JUAN AND OURAY COUNTIES.

Under date of September 28, 1905, I received a petition from the board of county commissioners of Ouray county stating that the portion of the south boundary line of the county of Ouray, being a portion of the north boundary line of the county of San Juan is indefinite and in dispute between said counties, they therefore petitioned the state engineer to run out and estab-



lish said line as nearly as may be in accordance with the description thereof.

On Oct. 16, 1906, a report was made to the honorable board of county commissioners of Ouray and San Juan counties substantially as follows:

In accordance with a petition received from Ouray county on October 9, 1905, a letter was written to the honorable board of county commissioners of San Juan county that before proceeding with this work, it would be advisable that a meeting be held with the parties in interest and suggesting that as early a date as possible be arranged for.

Thereafter, to-wit, on the 18th day of November, 1905, a meeting was held at Silverton, Colorado, at which time and place were present two of the county commissioners, county clerk, county attorney, county judge and county surveyor of San Juan county, and the chairman of the board of county commissioners, county attorney and a surveyor representing the county surveyor of Ouray county.

At this meeting the merits of the controversy were quite thoroughly gone into, and upon my request, the county attorney of each county was requested to submit affidavits and other evidence in regard to the county line in controversy, and at their request, the time for submitting such proof was agreed upon as February 1, 1906.

This evidence, together with the presentation of the case by the county attorney of each county as subsequently and prior to the 1st day of February, 1906, were received by me, and this taken in connection with my own investigation and research led me to the decision set forth in my letter of April 24, 1906, which is as follows:

"April 24, 1906.

"Honorable Board of County Commissioners, Ouray county, Ouray, Colorado, and San Juan county, Silverton, Colorado.

"Gentlemen:—I am in receipt of a petition from the honorable board of county commissioners of Ouray county, stating that owing to the indefinite description of the boundary line between San Juan and Ouray counties, and the inability of the county surveyors of each county to agree as to the location of this line, calling upon the State engineer, under statutory provisions, to establish the line as nearly as may be, in accordance with such defective description.

"A meeting was held at Silverton, at which there were present, the commissioners, attorneys, surveyors and citizens of each county, and myself, and a full presentation of the claims and reasons therefor were made and discussed. I also visited the localities in dispute.

"The controversy that has been formed in regard to the proper location of this boundary line, is based solely upon the identification of Mineral creek, and the main branch of the Uncompahgre river.

"The act of the General Assembly forming the county of Ouray, describes this line in the following language:

"San Miguel. That the county of Ouray (San Miguel) is hereby created and established, with the legal capacity and functions of other counties of this State, and with the boundaries as follows: commencing at a point on the boundary line between the counties of Hinsdale and San Juan, due east of the junction of Mineral creek and the main branch of the Uncompahgre river; thence due west through said junction to the summit of the divide between Red Mountain valley (and) Poughkeepsie gulch; (G. L. '77, p. 207, Par. 385; G. S. '83, p. 238, Par. 462, Sec. 755, M. A. S.)'

"It is contended on the part of San Juan county, that this mentioned junction applies to the confluence of Poughkeepsie creek and the stream into which it empties, and on the part of Ouray county, that the junction described in the act, is that of a creek flowing northward from Mineral point, and emptying into the (as claimed) Uncompahgre river.

"The data concerning the names of these streams have been searched for, among old and new maps, county records, official mining surveys, location certificates of mining claims, etc., and information has been received from affidavits of former and present residents of the locality and adjoining territory, as submitted by the county attorney of each county, as well as from personal conversation with people well informed upon this subject.

"There is no conflicting evidence as to the Uncompahgre river, beginning at Ouray, and following it up to the junction with Poughkeepsie gulch; except Mr. R. J. McNutt states that some people, at some time, called it 'Po'keepsie gulch clear down to the point where Red Mountain creek runs into the creek generally designated as the Uncompahgre river.'

"At this junction begins the confusion of names, it being contended by San Juan county, that the main branch of the Uncompahgre river flows down Poughkeepsie gulch and the other branch being Mineral creek.

"The claim that the main branch of the Uncompahgre river is in Poughkeepsie gulch, is not supported by any evidence, only the statement that some people so designated the stream in Poughkeepsie gulch.

"There is very full and corroborative evidence that the stream in Poughkeepsie gulch was known and called Poughkeepsie creek. The stream of the gulch is generally called the same name as the gulch, the names being used indiscriminately to

describe the ravine forming the valley. The gulch was named Po'keepsie gulch by Mr. R. J. McNutt, now county judge of San Juan county, who had mining property along this stream, and who was interested in perpetuating this name, and who states that 'the creek therein was consequently sometimes referred to as Po'keepsie creek.'

"The Poughkeepsie townsite was located at this junction, and was surveyed by C. A. Wheeler in December, 1883; both streams are shown on the map, the one from the south called Poughkeepsie creek, and flowed into the Uncompahgre river, so named, above and below the confluence of the streams. The statement is also made that the townsite is in Ouray county.

"Many patented mining claims are located across this stream from Lake Como to the junction, and without exception, the official plats of these properties in the U. S. Surveyor General's office, designate the stream as Poughkeepsie creek, and this name is corroborated by all the affidavits presented by Ouray county.

"The other branch from this junction is called Mineral creek in the affidavits (2) presented by San Juan county, and it is called the Uncompahgre river in the affidavits (8) received from Ouray county.

"I have not found a single map or document that calls this stream Mineral creek, and on the official plats of mining claims in the office of the U. S. Surveyor General, wherever the stream is named thereon, it is called Uncompahgre river or creek, except Survey No. 853, where it is called Simpson creek.

"Ouray county contends that the stream which heads near the old town of Mineral Point, and flows northward, is known as Mineral creek, and this claim is supported by the affidavits presented by it, and by maps in the U. S. Surveyor General's office, except as to Surveys No. 106 and 114, where it is called Rock creek, and is denied by the affidavit presented by San Juan county.

"The Uncompahgre river and Poughkeepsie gulch have been proven to be well known, and, having names not subject to error at the time (1877), when the statute establishing Ouray county was enacted by the Legislature, and had it been the intention of the Legislature that the junction at the mouth of Poughkeepsie gulch was to control the boundary line, the act could have used these names as being better known, and thus locating the line more definitely, but it was not done.

"In my opinion, 'the junction of Mineral creek and the main branch of the Uncompahgre river' has been sufficiently identified as being the junction of Mineral creek, a stream which heads near the old town of Mineral Point and flows into the main branch of the Uncompahgre river a short distance from the old Fred Smith cabins, and near the northeast corner of the Smithville lode mining claim of U. S. Survey No. 16,379.



"The statute under which this determination has been made requires that 'it shall be the duty of such State Engineer, in connection with the county surveyor of each such counties, to run and establish such lines \* \* \* and to fix and define such boundary line, by plain and substantial mounds and marks and unmistakable natural monuments.'

"I will be prepared to do the field work of surveying the line as soon as the ground is free from snow, and I would be pleased to have the assistance and co-operation of the county surveyors of each county in performing the work.

"Respectfully submitted,

"(Signed) T. W. JAYCOX,

"State Engineer."

Prior to August 13, 1906, a letter was sent to the county surveyors of the respective counties, notifying them that upon August 13, 1906, I would be prepared to make the survey of this line in accordance with my findings regarding the location of this line.

In accordance with the preceding arrangements, on the 13th day of August, 1906, Mr. A. J. Tanner, Jr., of Leadville, Colorado, representing me as State Engineer, and Mr. C. S. Thomas, county surveyor of Ouray county, met at Ouray, but San Juan county failed to send any representative to Ouray, neither was there any representative of said county upon the ground or assisting in this survey during any time.

Thereafter, the survey was begun by Mr. A. J. Tanner, Jr., Deputy State Engineer and Deputy County Surveyor Samuel Tescher, and was completed on the 31st day of August, 1906.

A complete report, consisting of the field notes, blue print of the survey duly signed and acknowledged by the said A. J. Tanner Jr., Deputy State Engineer, and Samuel Tescher, deputy county surveyor for Ouray county, was attached to said report and forwarded to the boards of county commissioners of each county.

In addition, I went upon the ground on August 18, 1906, and ascertained that the initial point taken for the survey was the junction of Mineral creek and the main branch of the Uncompahgre river as theretofore determined by me in my decision of April 24, 1906, and through this point a line was run due east and west from the boundary line between the counties of Hinsdale and San Juan on the east, to the summit of the Divide, and between Red Mountain valley and Poughkeepsie gulch on the west, and is more particularly described in the field notes and plat of the survey thereof, which was included in this report.



Under the statute an appeal can be made by either county that may be dissatisfied with the location as made by the State Engineer to the District Court, and whether this will be done I am not at this time informed, but trust this line so determined may be accepted by the counties as the permanent boundary line.

### ACKNOWLEDGMENTS.

I desire to extend my thanks to the various railroads of the State for the transportation furnished myself and assistants while engaged in the work of the office, and the interest taken by these companies in the development of the irrigation districts of the State has resulted in the accomplishment of a greater amount of work by the State irrigation officials, which has been due to the valuable assistance thus rendered.

I desire to commend the earnest and faithful work of the various division engineers, water commissioners and assistants in this office. The aid they have given me has materially lessened the labor and removed many unpleasant features connected with work of this office.

### STATEMENT OF FEES RECEIVED.

April 7, 1905, to December 1, 1906.

Filing fees, claims to water rights.....	\$3,228 .20	
Filing fees, transfer decrees.....	19 .00	
Approving plans of dams.....	128 .00	
Certifications.....	289 .50	
Office labor.....	338 .66	
Miscellaneous .....	129 .20	
TOTAL.....		\$4,132 .56

### STATE ENGINEER'S SALARY.

L. G. Carpenter, State Engineer.....	\$1,058 .34	
T. W. Jaycox, State Engineer.....	4,941 .66	
		\$6,000 .00

## DEPUTIES' AND ASSISTANTS' FUND.

P. J. Preston, Deputy State Engineer .....	\$1,248.00	
C. W. Wells, Deputy State Engineer .....	2,094.00	
C. W. Beach, Deputy State Engineer.....	1,896.00	
L. Bott, Stenographer.....	320.00	
R. P. Jackson, Clerk .....	675.00	
H. E. Rockwell, Clerk.....	928.57	
M. H. Griffith, Clerk .....	500.00	
R. C. Hecox, Clerk.....	157.91	
W. L. Turman, Clerk .....	66.67	
F. Cogswell, Gager.....	300.00	
G. A. Wall, Gager.....	134.84	
J. L. Hilton, Stenographer .....	192.33	
H. G. Osborne, Clerk.....	12.00	
P. O. Gaynor, Inspector.....	180.00	
M. E. Melvin, Clerk .....	126.67	
Lallie Surveying Instrument Co .....	8.70	
M. H. Griffith, Clerk .....	200.00	
TOTAL.....		\$9,010.69

## STENOGRAPHER'S SALARY.

H. Davidson.....	\$2,000.00	
M. H. Griffith .....	300.00	
J. L. Hilton.....	70.00	
TOTAL.....		\$2,370.00

## DRAUGHTSMAN'S SALARY.

George H. Angell.....	\$2,300.00	
M. H. Griffith .....	100.00	
TOTAL.....		\$2,400.00

## GAGING FUND.

Balance on hand, December 1, 1904.....	883.03	
Receipts of State Engineer, December 1, 1901, to November 30, 1906	4,884.89	
Warrants drawn .....	4,019.25	
Balance on hand, December 1, 1906.....	1,748.67	

## STATE ENGINEER'S EXPENSE FUND.

P. J. Preston, Deputy State Engineer .....	\$ 93.94
L. G. Carpenter, State Engineer.....	52.31
T. W. Jaycox, State Engineer.....	451.50
T. W. Jaycox, as Deputy State Engineer. ....	240.00
C. W. Wells, as Deputy State Engineer.....	221.30
C. W. Beach, as Deputy State Engineer .....	296.21
F. Cogswell, Gager.....	59.30
H. Davidson, Stenographer .....	70.00
J. L. Hilton, Stenographer.....	224.60
M. J. McKissock, Stenographer.....	18.50
M. H. Griffith, Clerk .....	191.93
W. J. Mayer, Clerk .....	133.07
Hall Blue Print Co .....	17.83
Denver Photo Material Co.....	58.93
W. F. Robinson Printing Co .....	1.50
Kistler Book and Stationery Co .....	7.48
Whitney Sporting Goods Co .....	48.00
Kendrick Book and Stationery Co .....	5.50
Smith Premier Typewriting Co.....	16.40
Colorado Typewriting Co. ....	13.00
Remington Typewriting Co .....	5.00
Haberl Lapidary and Jewelry Co .....	12.50
Press Clipping Bureau .....	97.55
J. S. J. Lallie Surveying Instrument Co.....	77.22
Colorado Springs Gazette.....	5.58
Glenwood Post.....	1.87
Boulder Livery Co.....	16.00
Allen and Allen .....	14.00
Ben Nehr.....	30.50
W. M. Fay, County Clerk.....	2.50
H. R. Meininger, Gage reader .....	5.00
Bert Schmaling, Gage reader.....	6.00
C. E. McKinny, Gage reader .....	6.80
E. H. Jardine, Gage reader .....	21.00
David J. Cox, Gage reader.....	12.00
C. W. Hoisington, Gage reader .....	9.00
J. L. Prentiss, Gage reader.....	15.00
Roman Mondragon, Gage reader.....	15.00
C. Osgood, Gage reader.....	5.00
A. L. Gibson, Gage reader .....	9.00

A. Foley, Gage reader ..	6.00
R. E. Chesebro, Gage reader ..	6.00
Ed. Autrey, Gage reader .....	3.00
J. F. Arbuckle, Gage reader .....	2.25
F. A. Richardson, Gage reader .....	16.20
W. H. King, Gage reader ..	12.20
R. Adams, Gage reader .....	11.25
V. Parker, Gage reader ..	10.75
E. K. Plumb, Gage reader ..	15.00
C. Crisman, Gage reader ..	9.00
P. O. Gaynor, Inspector ..	186.00
A. H. Stokes, Inspector .....	21.75
G. A. Wall, Gager .....	60.50
Wm. Ainsworth and Sons .....	27.55
Universal Drafting Machine Co ..	8.00
M. H. Griffith, Clerk ..	1,000.00
TOTAL ..	\$3,983.27



## CHAPTER II.

## INTERNAL IMPROVEMENTS.

The Congress of the United States, in its wisdom in passing the various acts granting to the several states assistance, deemed it wise to give aid to be used in making internal improvements and when it passed the enabling act, allowing the State of Colorado to assume statehood rights, it provided further that 5 per cent. of the proceeds derived from the sale of certain lands should be used for internal improvements. Following will be found the sections of the U. S. statutes referred to: Act of Congress of September 4, 1841, Sec. 8, p. 455, 5 U. S. Statutes at Large.

"And be it further enacted, that there shall be granted to each state specified in the first section of this act, five hundred thousand acres of land for purposes of internal improvement, Provided, That to each of the said states which has already received grants for said purposes, there is hereby granted no more than a quantity of land which shall, together with the amount such state has already received as aforesaid, make five hundred thousand acres; the selection in all of the said states to be made within their limits respectively in such manner as the legislation thereof shall direct, and located in parcels conformably to sectional divisions and subdivisions of not less than three hundred and twenty acres in any one location on any public land, except such as is or may be reserved from sale by any law of Congress or proclamation of the President of the United States, which said location may be made at any time after the lands of the United states in said states respectively shall have been surveyed according to existing laws. And there shall be and hereby is granted to each new state that shall be hereafter admitted into the Union, upon such admission, so much land as, including such quantity as may have been granted to such state before its admission, and while under territorial government, for purposes of internal improvement as aforesaid, as shall make five hundred thousand acres of land, to be selected and located as aforesaid."

Sec. 9, p. 455, U. S. Statutes at Large:

"And be it further enacted, That the lands herein granted to the states above named shall not be disposed of at a price less than one dollar and twenty-five cents per acre, until otherwise authorized by a law of the United States; and the net proceeds of the sales of said lands shall be faithfully applied to objects of internal improvement within the states aforesaid, respectively named, roads, railways, bridges, canals and improvements of water courses, and draining of swamps, and such roads, rail-

ways, canals, bridges and water courses, when made or improved, shall be free for the transportation of the United States mail, and munitions of war, and for the passage of their troops, without the payment of any toll whatever."

The act of Congress of September 4, 1841, limited the use of the internal improvement fund, arising from the sales of lands donated to the states, to certain designated objects. This provision was repealed in the revision of the United States statutes in 1878, and the following provision substituted: "There is granted for the purpose of internal improvements to each new state hereafter admitted into the Union, upon such admission, so much public land as, including the quantity granted to such state before its admission and while under a territorial government, will make five hundred thousand acres." R. S. U. S., 1878, Par. 2378.

The repeal of the former provision shows an intent to leave the designation of the objects of internal improvement to which this fund may be applied to the direction of the proper state authorities. Act of Congress of March 3, 1875, providing for the admission of Colorado as a State into the Union. Sec. 12:

"That five per centum of the proceeds of the sales of agricultural public lands lying within said State, which shall be sold by the United States subsequent to the admission of said State into the Union, after deducting all the expenses incident to the same, shall be paid to the said State for the purpose of making such internal improvements within the said State as the Legislature thereof may direct; *Provided*, That this section shall not apply to any lands disposed of under the homestead laws of the United States, or to any lands now or hereafter reserved for public or other uses."

Under these sections there is no limit to the powers of the General Assembly over the funds thus created, except that it shall be used for internal improvements. In the past the amount of this fund has been anticipated by each General Assembly and appropriations made from the same for proposed improvements, such as roads, bridges, artesian wells and reservoirs in the various counties of the State.

The Fifteenth General Assembly was presented with many demands for aid from different sections of the State, all of which were worthy of consideration. All could not be taken care of from the amount that could safely be anticipated as being in the internal improvement fund during the time until the next General Assembly should meet. As a result, the following bills were passed, and signed by the Governor and became statutory laws:

No. of Chapter of 1905 Ses- sion Laws	COUNTY BENEFITED BY IMPROVEMENT	KIND OF WORK	AMOUNT
2	Washington.....	Artesian well.....	\$6,000 .00
4	La Plata.....	Bridge.....	3,000 .00
5	Prowers.....	Bridge.....	4,000 .00
6	Prowers.....	Bridge.....	5,000 .00
7	Morgan.....	Bridge.....	2,000 .00
8	Jefferson and Adams.....	Bridge.....	1,500 .00
9	Clear Creek.....	Bridge approach.....	500 .00
10	Conejos.....	Bridge.....	3,500 .00
11	Dolores.....	Bridge.....	2,000 .00
12	Las Animas.....	Bridge.....	6,000 .00
13	Conejos and Costilla.....	Bridge.....	7,000 .00
14	Rio Grande.....	Bridge.....	4,000 .00
15	Archuleta.....	Bridge.....	3,000 .00
16	Las Animas.....	Bridge.....	2,000 .00
17	Routt.....	Bridge.....	5,000 .00
54	Clear Creek.....	Wagon road.....	2,500 .00
55	Bent.....	Wagon road.....	3,000 .00
56	Boulder and Grand.....	Wagon road.....	5,000 .00
57	El Paso and Teller.....	Wagon road.....	3,500 .00
58	Garfield, Rio Blanco & Routt	Wagon road.....	6,000 .00
59	Eagle and Garfield.....	Wagon road.....	5,000 .00
60	Douglas.....	Wagon road.....	3,000 .00
61	Eagle.....	Wagon road.....	5,500 .00
62	Grand.....	Wagon road.....	5,000 .00
63	Grand.....	Wagon road.....	6,500 .00
64	Hinsdale.....	Wagon road.....	3,500 .00
65	Otero.....	Wagon road.....	4,000 .00
66	La Plata.....	Wagon road.....	6,000 .00
67	Larimer and Boulder.....	Wagon road.....	10,000 .00
68	Mesa.....	Wagon road.....	2,500 .00
69	Montrose.....	Wagon road and bridge ..	2,000 .00
70	Pitkin.....	Wagon road.....	3,000 .00
71	Summit.....	Wagon road.....	3,000 .00
72	Teller and Fremont.....	Wagon road.....	10,000 .00
73	Yuma.....	Wagon road.....	3,000 .00

There was carried over from my predecessor the following appropriations which had not been expended, although in several cases their expenditure had been provided for:

No. of Chapter of 1903 Session Laws	COUNTY BENEFITED BY IMPROVEMENT	KIND OF WORK	AMOUNT
53	Chaffee, Lake and Eagle.....	Wagon road.....	\$1,438.05
56	Dolores.....	Wagon road.....	2,814.12
57	Douglas.....	Wagon road.....	1,901.05
58	Eagle.....	Wagon road.....	3,750.37
60	Gunnison.....	Wagon road.....	3,074.11
63	La Plata.....	Wagon road.....	3,712.95
4	Las Animas.....	Artesian well.....	4,766.24
67	Pitkin.....	Wagon road.....	4,000.54
7	Prowers.....	Bridge.....	1,940.95
69	Summit.....	Wagon road.....	903.00

This made a total of \$146,500.00 appropriated by the Fifteenth General Assembly from said fund and \$27,398.38 appropriated by the Fourteenth General Assembly, and either not used for the projects for which it was appropriated or the project was not completed at the beginning of the present State Engineer's term of office, making a grand total of \$173,898.38 to be expended during the biennial period just closed. While in many cases the amount appropriated was inadequate to do the work intended, I was able to satisfy the requirements, either by having the county commissioners of the county in which the improvement is situate supply the deficiency or curtailing the extent of the project until it came within the amount of the available funds.

In order to more fully exemplify the quantity and quality of the various projects handled, I will present to you a detailed outline of each individual case.

#### WASHINGTON COUNTY ARTESIAN WELL.

House Bill No. 237 appropriated \$6,000.00 to be used for the purpose of sinking an artesian well, the exact location to be selected by the board of supervision, to be composed of the State Engineer, chairman of the board of county commissioners of Washington county (Hon. Mark B. Gill), and the county clerk of Washington county (Hon. Hugh C. Black).

The matter of selecting a suitable location was taken up at an early date during my term, and I made a personal examination on the ground. After considering all propositions submitted as to a suitable site, the board selected the S. E.  $\frac{1}{4}$  of the N. W.



$\frac{1}{4}$  of the N. E.  $\frac{1}{4}$  of Sec. 25, T. 3, N., R. 53 W., of the 6th P. M., providing the owners would give the State a warranty deed, fee simple, to the same and not have a conditional reversion clause in the document, which was done.

The time for receiving proposals closed January 6, 1906, and the board was favored with one bid. The prices therein were as follows:

With casing 13	inches in diameter,	\$7.50 per lineal foot.
With casing 10	inches in diameter,	7.00 per lineal foot.
With casing $8\frac{1}{4}$	inches in diameter,	6.50 per lineal foot.
With casing $6\frac{3}{8}$	inches in diameter,	6.00 per lineal foot.
With casing 5	inches in diameter,	6.00 per lineal foot.
With casing $4\frac{1}{4}$	inches in diameter,	6.00 per lineal foot.

The above prices appeared to the board to be excessive, consequently it was rejected and arrangements made to re-advertise, asking for bids to be again submitted by February 24, 1906. At this time we were not favored with a bid, and again asked that proposals be submitted by March 31, 1906, and again we did not receive any proposal. We re-advertised, asking that bids be submitted by April 28, 1906. At that date one bid was submitted by Messrs. Albert Brown, of Florence, and Charles Younglove, of Boulder, their bid being as follows: To commence at the surface of the ground and drive a hole sufficiently large to receive a 10-inch pipe; then a hole sufficiently large to receive an  $8\frac{1}{4}$ -inch pipe; then a hole large enough to receive a  $6\frac{1}{4}$ -inch pipe; then a hole large enough to receive a  $4\frac{1}{4}$ -inch pipe; each size to be sunk to such a depth as the contractor and the State Engineer should consider necessary. To be cased from top to bottom with whatever sized pipe the last sized hole drilled will receive, if deemed necessary by the State Engineer. Well to be driven to a depth of 1,140 lineal feet for \$5,700.00, and \$5.00 per lineal foot for each foot sunk thereafter. This bid was considered equitable, and on the 15th day of May the board entered into contract with Messrs. Brown and Younglove to sink the well as above outlined, to be completed by the 30th day of November, 1906.

The well was inspected and measured and was found to be to a depth of 1,146 lineal feet and to be cased with  $8\frac{1}{4}$ -inch casing for 1,120 lineal feet. The contractor was paid on the 1st day of September, 1906, \$5,730.00 for the same.

A flow of artesian water was not obtained. At the present time the water stands in the well at a level 238 feet below the surface of the ground. At the time the well had reached a depth of 806 feet the water rose to within 175 feet of the surface of the ground and the well produced 24 gallons of water per minute of time. No water-bearing material was encountered

between this depth and the bottom of the well, and a considerable amount of the water has been cased off.

This well has a double casing for the first 355 feet. For that distance the contractors put down a temporary 10-inch casing, expecting to draw it when they had finished drilling, and they placed an 8¼-inch casing from the top to within 26 feet of the bottom. They were afterward unable to draw the 10-inch casing and it still remains.

## FORMATION PENETRATED.

THICKNESS OF STRATA	DEPTH FROM SURFACE	MATERIAL
85 feet	85 feet	Gravel
70 feet	155 feet	Shale
2 feet	157 feet	Lime—small flow of water
148 feet	305 feet	Shale
3 feet	308 feet	Lime, water rose to within 100 feet of surface
192 feet	500 feet	Shale
23 feet	523 feet	Light colored shale
2 feet	525 feet	Lime—water
252 feet	777 feet	Shale
125 feet	902 feet	Light colored shale
4 feet	904 feet	Lime
242 feet	1,146 feet	Pierre shale

## FINANCIAL STATEMENT.

Appropriation.....		\$6,000.00
C. W. Wells, Deputy State Engineer, salary while looking after well.....	\$ 84.00	
C. W. Wells, expense connected with above .....	19.15	
Advertising for proposals five times. ....	30.17	
H. C. Black, recording deed.....	2.50	
Albert Brown and Charles Younglove.....	5,730.00	
Balance in fund.....	134.18	
	\$6,000.00	\$6,000.00

## LA PLATA COUNTY BRIDGE.

House Bill No. 323 appropriated \$3,000.00 to be used towards constructing a bridge across the Animas river at or near La Posta, La Plata county.

The board of construction to consist of the Governor, the county surveyor of La Plata county (Mr. W. H. Wiggles-

worth), and the chairman of the board of county commissioners of La Plata county (Hon. George C. Logan).

The exact location was to be selected by the Board. Two sites were presented by interested parties; one at Frazier's ranch, which is at La Posta; another  $2\frac{1}{2}$  miles down the river, near Smith's ranch. After making an examination on the ground, the site at the Frazier ranch was selected, and upon request of the Governor, plans, specifications and form of contract were prepared. Advertisements were placed in a Durango and a Denver paper asking that bids be submitted on or before February 23, 1906. Several bids were submitted; upon opening them it was found that the bid from The M. J. Patterson Contracting Company proved to be the lowest, and was accepted, being a proposition to build the bridge complete as specified for \$3,200.00. This was a sum larger than the appropriation; but the county commissioners of La Plata county passed a resolution agreeing to pay to the contractor the amount the contract price proved to be in excess of the appropriation after all the legitimate expenses were deducted, providing the amount did not exceed \$500.00. With this understanding, the contract was executed and November 2, 1906, set as the time by which the bridge should be completed.

This is a steel bridge of two 90-foot truss spans; joists and floor to be New Mexico pine, 14-foot roadway, having wooden cribs filled with rocks for abutments and pier.

After the contract was let, the county surveyor of La Plata county took charge of the construction and on November 1st it was completed. On the 13th day of November it was accepted by the board and the contractor settled with in full.

## FINANCIAL STATEMENT.

Appropriation by state.....		\$3,000.00
Appropriation by county.....		267.59
C. W. Wells, salary trip of inspection of site, work on plans, specifications and contract.....	\$ 48.00	
C. W. Wells, expense account on above.....	4.45	
Wood and Morgan, livery.....	11.00	
Advertising notice to contractors.....	4.14	
The M. J. Patterson Contracting Company.....	3,200.00	
	\$3,267.59	\$3,267.59

## PROWERS COUNTY BRIDGE—MOORSE SIDING.

House Bill No. 295 of the Fourteenth General Assembly appropriated \$2,000.00 to be used in constructing a bridge on the township line between Tps. 22 and 23 S. and R. 45 and 46 W. of the 6th P. M., across the Arkansas river in Prowers county. Surveys and estimates of the cost were made by my predecessor and it appeared that the bridge could not be built for that amount of money, and the balance, \$1,940.95, was in the fund at the beginning of the present administration.

Senate Bill No. 83 appropriated \$4,000.00 to be used for the construction of the same bridge.

In the bill passed by the Fourteenth General Assembly, the State Engineer with the board of county commissioners were to constitute the board of construction. The act of the Fifteenth General Assembly provided that the State Engineer and the chairman of the board of county commissioners should constitute the board of construction, whose duties should be similar to those of the board named in the previous bill. In order to harmonize matters, the board of county commissioners delegated the chairman to look after the construction in conjunction with the State Engineer. The board of county commissioners were Hon. T. J. Saylor, chairman, W. W. Reynolds and Joel Knowlen.

On July 1st, 1905, a very careful survey was made of the river crossing on the range line called for in the statutes, and it developed that it would take 1,100 feet of bridging to span the river. It was apparant that to go down the river 530 feet it would require a bridge 690 feet in length. It was decided that the proper action to take would be to digress from the literal wording of the act, and build the bridge at such point as would permit the money to complete it. A right of way deed was obtained from the owner of the land for outlets from the bridge to the county road on each side of the river as well as for the land on which the bridge was to stand. This right of way is a strip of land 60 feet wide, 1,320 feet long and was donated by the American Beet Sugar Company through Manager W. K. Winterhalter at Lamar.

Plans and specifications were prepared for a pile bent bridge; 30 feet panels, 16 feet roadway, bridge to be 690 feet in length. Proposals were asked for by advertising in one local paper in Prowers county and in one paper in Denver. The expiration of the time for receiving bids was named as August 5th, 1905. At that time the board met in the State Engineer's office and opened the following proposals:



The Pueblo Bridge Company, Pueblo, Colorado .....	\$5 75 per lineal foot
Chas. G. Sheely, Denver, Colorado. ....	5 87 per lineal foot
The Kansas City Bridge Company, Kansas City, Missouri. ....	5 89 per lineal foot
The Western Engineering Company, Denver, Colorado. ....	6 34 per lineal foot
The Midland Bridge Company, Kansas City, Missouri. ....	6 39 per lineal foot
The Canton Bridge Company, Kansas City, Missouri. ....	6 50 per lineal foot
John W. Towle, Omaha, Nebraska. ....	6 59 per lineal foot
Manville and Tilson, Lamar, Colorado. ....	7.00 per lineal foot
The Comstock Construction Company, Denver, Colorado. ....	7.80 per lineal foot

The Pueblo Bridge Company being the lowest, the work was awarded it, and a contract was entered into on August 5th, 1905, by which the bridge was to be completed on or before October 10th, 1905. However, on account of difficulty in getting prompt delivery of material and encountering unforeseen obstacles in driving the piling, the time for completion was extended to February 10th, 1906.

The board deemed it advisable to place an inspector to keep a record of each pile in every bent. Mr. John S. Titcomb was appointed to act as such inspector. Instead of being able to drive the pile 25 feet in depth, as specified, it was found that at a depth of 15 feet they encountered an impenetrable stratum, and that the pile would be driven to destruction before they would go deeper than about 15 feet. The inspector was instructed to use his judgment as to when to cease driving each separate pile.

The original specifications were changed during construction, using oak for flooring instead of pine, as originally intended.

On the 17th day of January, 1906, the contracting company gave notice that it had completed the work, on the 19th day of January the bridge was inspected, and on the 3rd day of February it was accepted and final payment made.

After the bridge had been constructed, the board decided that the acts making the appropriations were broad enough to permit the building of the approaches from the fund. This work was measured and required 3,200 cubic yards of material to construct a suitable approach at each end of the bridge. Advertisements were put in the papers asking that bids be submitted until February 3rd. At that time the board was favored with two bids; one for 25 cents per cubic yard, and one for 26 cents per cubic yard. These bids, being considered excessive, were rejected and the work readvertised, asking that bids be submitted by April 9th, 1906. At this time there were two bids, namely: Mr. John P. Ford proposed to do the work for 17½ cents per cubic yard and Messrs. A. P. Mead and J. F. Mitchell proposed to do the work for 15 cents per cubic yard. The latter bid

was accepted and on the 18th day of April the board entered into contract, requiring the work to be completed by the 25th day of May, 1906. On May 18th, 1906, this office was notified that the contractors had completed the approaches. They were inspected at once and accepted and final settlement made May 25th, 1906.

## FINANCIAL STATEMENT.

Appropriation 1903.....		\$1,940.95
Appropriation 1905.....		4,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 108.00	
C. W. Wells, expenses connected with above.....	43.01	
Advertising notice to contractors.....	8.97	
C. W. Beach, salary for three trips of inspection.....	18.00	
C. W. Beach, expense for three trips of inspection.....	31.20	
John S. Titcomb, salary as inspector.....	296.00	
John S. Titcomb, expense as inspector.....	10.40	
T. J. Sayler, salary as inspector, 4 days at \$5.00.....	20.00	
Pueblo Bridge Company, on contract.....	4,383.95	
A. P. Mead and J. F. Mitchell, on contract.....	481.50	
Balance in fund.....	539.92	
	\$5,940.95	\$5,940.95

## PROWERS COUNTY BRIDGE—HOLLY.

Senate Bill No. 85 appropriated \$5,000.00 to be used for the construction of a bridge across the Arkansas river, in Prowers county, at the most available location on said river on sections 14, 15, 22 and 23, in T. 23, S. R. 42 W., the exact location to be selected by the board of construction named in the act, and which was composed of the State Engineer and chairman of the board of county commissioners of Prowers county (Hon. W. W. Reynolds, 1905; Hon. T. J. Sayler, 1906).

On July 1, 1905, an inspection was made of the sites proposed for this bridge, there being two within the limits fixed by the act; one being an extension of Fourth street of the town of Holly; the other being one-fourth of a mile farther down the river on a section line, and having a wagon road to and from it, there being a ford there that has been in use for a great many years. At the first site it required 840 feet of bridging to span the river; at the other site 1,340 feet would be required. Aside from the extra cost, the site on the section line was considered the proper place for the bridge.

Realizing that to construct the bridge at either site would require aid from the board of county commissioners, it was



Pile Bridge, Arkansas River, Morse Siding, Prowers County.



Reinforced Concrete Bridge, Guadalupe, Conejos County.





deemed proper to allow them to select the site, they finally selecting the 1,340 feet bridge, for which, by proper resolutions, they agreed to take care of the deficiency. Plans and specifications were then prepared for a pile bridge, four white oak piles to the bent; panels thirty feet long, roadway sixteen feet, Oregon fir lumber, and an advertisement inserted in one Prowers county paper and in one Denver paper, asking that proposals be submitted for the construction of the bridge, per lineal foot. On the 5th day of August, 1905, the board met and opened the following proposals:

Charles G. Sheely, Denver, Colorado.....	\$5.87 per lineal foot
Pueblo Bridge Company, Pueblo, Colorado.....	5.90 per lineal foot
Kansas City Bridge Co., Kansas City, Mo.....	5.97 per lineal foot
The Western Engineering Co., Denver, Colo.....	6.39 per lineal foot
John W. Towle, Omaha, Nebraska.....	6.59 per lineal foot
Manville & Tilson, Lamar, Colorado.....	7.00 per lineal foot
The Comstock Construction Co., Denver, Colo.....	7.80 per lineal foot

The Pueblo Bridge Company, having been previously granted the contract for the other Prowers county bridge let the same day these bids were opened, at a considerably lower price than the next lowest bidder, and the board thinking that the matter could be handled at much less expense by having the same contractor in charge of both the Prowers county bridges, it was decided by them to award the company this contract. In pursuance of this policy, on the same day that the bids were opened, the board of construction entered into a contract with The Pueblo Bridge Company to build 840 feet of bridging for \$5.90 per lineal foot, to be built at the site selected by the board of county commissioners, to commence on the north side of the river and build south; to be completed on or before the 13th day of October, 1905. Owing to difficulty in getting prompt delivery of material, the contractor was unable to begin work on the ground until December 3, 1905. On October 10, 1905, the contracting company asked that the time be extended. After fully considering all facts connected with the case the board of construction extended the time until December 13, 1905. On November 6, 1905, the county commissioners gave a contract on The Pueblo Bridge Company to complete this bridge by constructing an additional 500 feet at \$5.98 per lineal foot, the same to be completed on or before 100 days thereafter. The State fund being sufficient to pay for the 840 feet of bridge contracted and to pay a few of the minor expenses incurred by the State Engineer's office, the county commissioners agreed to pay for an inspector to be present during the driving of the piling, and on December 11, 1905, Mr. Joel Knowlen was appointed by this office to such position. On February 10, 1906, notice was received that the 840 feet of bridging being done under contract

with the State was completed, and on the 6th day of March, 1906, an inspection was made of it. No other extension was asked for, but considering that the addition to be constructed under contract with the county commissioners was to be completed by February 14, and that it was not completed at the time the State work was being inspected, and that the 840 feet built by the State could not be used until the other 500 feet was completed, the board considered that it would not be equitable to enforce the forfeiture clause of the contract, and decided to accept the work and settle with the contractor for the same without the per diem forfeiture, which was done on March 9, 1906.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$5,000 00
Appropriated by Prowers County.....		3,500 00
C. W. Wells, salary as deputy while in charge of the work.....	\$ 24.00	
C. W. Wells, expenses connected with above.....	14.93	
Advertising for bids.....	5.07	
Pueblo Bridge Company, on contract.....	4,956.00	
Pueblo Bridge Company, paid by county.....	3,500.00	
	\$8,500.00	\$8,500 00

## MORGAN COUNTY BRIDGE.

Senate Bill No. 138 appropriated \$2,000.00 to be used to construct a bridge across Bijou creek, in Morgan county, at some point near Vallery Station, the board of construction to consist of the Governor, the State Engineer and the chairman of the board of county commissioners of Morgan county. The exact location of the bridge site was to be selected by the board of construction.

On May 9, 1906, the Governor and State Engineer went to Fort Morgan and on May 10, in company with Hon. J. T. Ross, chairman of board of county commissioners, inspected such sites as were presented by those who were interested. No definite action was taken, as there were two sites suggested, each having a goodly number of supporters. The chairman of the board of county commissioners was requested to have petitions prepared in support of the sites and to look after having the right of way for the site, as well as of a road to and from whatever sites presented, donated to the State for road purposes. On the 6th day of July, 1906, the State Engineer, with the Hon. John T. Ross, listened to the petitioners supporting the various sites, after which a final selection was made by placing it at a point 590 feet east and 1,295 feet north of the southeast corner of section 2, T. 3 N., R. 59 W., of the 6th P. M.

Plans and specifications were then prepared for a bridge, four piles, 25 feet long to the bent, 16 feet in width, 30 feet panels, to be constructed of red spruce piling and Oregon fir lumber; bridge to be not less than 330 feet long, and advertised asking that proposals be submitted by September 1, 1906. The Governor and State Engineer opened the bids on that date, which were as follows:

C. G. Sheely, Denver, Colorado .....	\$9.50 per lineal foot
W. E. Edom, Englewood, Colorado .....	9.00 per lineal foot
Smith & Welton, Fort Morgan, Colorado .....	7.73 per lineal foot

Smith & Welton being the lowest bidder, theirs was considered a reasonable bid for the bridge specified. To construct 330 feet of bridging would cost \$2,550. This, with the necessary expenses, would make the completed work cost not less than \$2,750.00, which was \$750.00 in excess of the amount appropriated. A request was made to the county commissioners that they aid the State to the extent of \$750.00; but the county was without funds. Plans were then prepared for a bridge with three 20 feet piles to a bent, 14 feet wide, 320 feet long, without bracing on the piling, and advertised for bids to be submitted on or before September 24, 1906. On that date the board was favored with the following bids, which were opened on the 25th day of September:

C. G. Sheely, Denver, Colorado .....	\$5.69 $\frac{3}{4}$ per lineal foot
Jas. B. Jackson, Denver, Colorado .....	6.18 per lineal foot
Smith & Welton, Fort Morgan, Colorado .....	6.20 per lineal foot

C. G. Sheely being the lowest bidder, the work was awarded him and on the 28th of September, 1906, a contract was entered into, the bridge to be completed on or before December 1, 1906. Afterwards the length of the bridge was extended from 320 feet to 335 lineal feet, the additional 15 feet to be at the same price. Owing to inability to obtain Oregon fir, the contractor's time was extended to January 1, 1907.

## FINANCIAL STATEMENT.

Appropriation .....		\$2,000.00
C. W. Wells, salary as deputy state engineer in charge of work. .	\$ 12.00	
Expense on above .....	2.00	
Advertising notice to contractors .....	8.76	
*Inspector and expense during construction .....	45.82	
Contractor on contract pledged .....	1,931.42	
	\$2,000.00	\$2,000.00

\*Anticipated.

## JEFFERSON AND ADAMS COUNTIES BRIDGE.

Senate Bill No. 104 appropriated \$1,500.00 to be used to complete the construction of a State bridge across Clear creek on the county line between the counties of Jefferson and Adams.

The State Engineer, the chairman of the board of county commissioners of Jefferson county (Hon. Wm. H. Light) and the chairman of the board of county commissioners of Adams county (Hon. Edward Fitzpatrick), were constituted a board of construction.

It was evident from the outset that the amount appropriated would not complete the structure. It was decided to build as much bridge to correspond with the previously constructed one as could be done with the appropriation. Plans and specifications were prepared and an advertisement run in one Denver paper, asking that proposals be submitted on or before May 26, 1906, for the construction of two 42-foot pony truss spans of steel, 16-foot roadway, supported by tubular piers. On that date the board of construction met in the State Engineer's office. The following proposals were presented and opened:

Charles G. Sheely, Denver, Colo.....	\$1,975.00
The M. J. Patterson Contracting Co., Denver, Colo.....	1,599.00

The M. J. Patterson Contracting Company's bid was the lowest, but was in excess of the appropriation \$99.00.

In order to be able to construct the two spans as proposed, it was estimated that it would be necessary for the counties of Jefferson and Adams to assist to the amount of \$100.00 each, which they agreed to do, and on the 23d day of June, 1906, the board of construction entered into a contract with the M. J. Patterson Contracting Company to complete the entire work on or before the 1st day of December, 1906, for the sum of \$1,599.00.

On the 16th day of November the contracting company gave notice that the work was completed and asked that an inspection be made, which was done on the 17th inst., the work was accepted and final settlement made for the same.

## FINANCIAL STATEMENT.

Appropriation by state.....		\$1,500.00
Appropriation by Adams County.....		64.50
Appropriation by Jefferson County.....		64.50
C. W. Wells, salary as deputy in charge of work.....	\$ 18.00	
C. W. Wells, expense in connection with above.....	9.15	
Publishing notice to contractors.....	2.85	
The M. J. Patterson Contracting Company.....	1,599.00	
	\$1,629.00	\$1,629.00



## CLEAR CREEK COUNTY BRIDGE.

House Bill No. 134 appropriated \$500.00 to be used to complete the earth approaches to a bridge which had been constructed across the Middle Fork of Clear creek at the town of Empire, Clear Creek county.

The State Engineer, chairman of the board of county commissioners (Hon. Frank A. Maxwell), and the mayor of the town of Empire (Hon. W. P. Clough), were made a board of construction. After a meeting of the board at Empire, it was decided that the work had best be cross-sectioned and the exact yardage computed. It developed that to properly perform the work it would require 1062.5 cubic yards to be moved with an average haul of 300 feet. An advertisement was inserted in a Georgetown paper asking that bids be submitted on or before the 20th day of June, 1905. On that day the Board met and received the following bids:

Charles Heckman, Empire, Colorado.....	\$424.00
P. K. Brie & W. B. Milne, Georgetown, Colorado.....	375.00
Julien Fountain & Geo. W. Marshall, Georgetown, Colorado.....	370.00

Messrs. Fountain and Marshall having the lowest bid, the work was awarded to them, and on the 21st day of June, 1905, they entered into a contract with the board, agreeing to complete the work on the 20th day of July, 1905. On the 14th day of July the State Engineer received notice that the work had been completed and on the 16th an inspection was made and the work accepted; on the 24th day of July the contractors were settled with in full.

## FINANCIAL STATEMENT.

Appropriation.....		\$500.00
C. W. Wells, salary in charge of improvement.....	\$ 36.00	
C. W. Wells, expenses.....	10.95	
Advertising notice to bidders.....	2.25	
Fountain and Marshall, contractors.....	370.00	
Balance in account.....	80.80	
	\$500.00	\$500.00

## CONEJOS COUNTY BRIDGE.

House Bill No. 181 appropriated \$3,500.00 to be used to construct a bridge across Conejos river at or near the town of Guada-

lupe in Conejos county, the exact location and the material used to be determined by the board of construction.

The Governor, State Engineer and the chairman of the board of county commissioners of Conejos county (Hon. J. B. Chapman), were constituted a board of construction. It was decided to construct the new bridge upon the site of the old one, and after fully considering the question of material, reinforced cement was selected and plans and specifications prepared for three reinforced concrete arches, making a bridge with 120 feet of waterway and a total length of 142 feet, with a maximum height of 8 feet waterway, with a 16-foot roadway. This bridge is constructed with concrete composed of one part the best Portland cement, two parts clean, sharp sand and four parts screened gravel. This is bound together with corrugated steel rods placed in such position as will permit them to take up the tensile forces. About 1 per cent. of the aggregate is steel.

An advertisement was placed in one paper in Conejos county, one paper in Denver and in the Engineering News, New York, asking that bids be submitted April 4, 1906. At that time the board met in the State Engineer's office and the following proposals were received:

The Walter Sharp Bridge Company, Raton, New Mexico, without wing walls	\$3,588.00
Additional for wing walls	700.00
The Commonwealth Concrete Construction Company, with wing walls	4,500.00

The Walter Sharp Bridge Company's proposal being the lower, was accepted, providing the county of Conejos would agree to take care of all cost of the bridge in excess of what would still remain to the credit of the State fund after all legitimate expenses were cared for, and on the 7th of April, 1906, the board of county commissioners passed a resolution agreeing to care for such excess, providing it did not exceed \$700.00. In order to bring the bridge within the available money and have enough to take care of the necessary expenses, it was agreed to cut down the wing walls sufficiently to bring the contract price down to \$4,000.00. On the 1st day of May, 1906, the board of construction and the board of county commissioners of Conejos county entered into a contract with the Walter Sharp Bridge Company to construct the bridge for the sum of \$4,000.00 and to complete the same on or before the 10th day of November, 1906. It was deemed advisable to have an inspector present while this bridge was being constructed, and Mr. P. O. Gaynor was appointed to the position, who acted in such capacity until the work was erected. Owing to the inability of the contracting firm to obtain material and men, it was impossible for them to complete the work by the specified time and an extension was granted until December 1, 1906. On the 27th day of November notice was re-

ceived that the bridge was completed. The river being low at the time, it was considered more profitable to allow the cement to thoroughly set than to have the use of the bridge, so it was not ordered opened for travel until December 12, 1906.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$3,500.00
Appropriated by county.....		700.00
M. S. Ketchum, report on plans.....	\$ 25.00	
C. W. Wells, salary as deputy in charge of work.....	36.00	
C. W. Wells, expenses on above.....	2.20	
Antoine Jacob, surveying site one day.....	6.00	
Antoine Jacob, expenses on above.....	5.40	
P. O. Gaynor, inspector.....	36.00	
Advertising notice to contractors.....	15.38	
Walter Sharp Bridge Co. on contract.....	3,200.00	
Due to contractors.....	800.00	
Remaining in fund.....	74.02	
	\$4,200.00	\$4,200.00

## DOLORES COUNTY BRIDGE.

House Bill No. 28 appropriated \$2,000.00 to be used in constructing a bridge across the East Fork of the Dolores river, at or near a point three miles north of the town of Rico in Dolores county, the exact location to be determined by the board of construction.

The State Engineer and the chairman of the board of county commissioners (Hon. Victor H. Lee) to constitute the board of construction. On July 2, 1906, the board inspected the vicinity of the proposed site and selected a location 30 feet below the site of the old bridge. It was decided to construct a low truss bridge of four 15-foot panels, 60 feet long, 16 feet roadway. All lumber used to be native yellow pine; the substructure to be tubular piers filled with concrete. An advertisement was placed in one Rico paper and one Denver paper asking that proposals for the construction of the bridge be submitted on or before October 15, 1906, and the board was favored with the following bids:

C. G. Sheely, Denver, Colorado	\$1,995.00
The Denver Bridge Company, Denver, Colorado	1,975.00

The Denver Bridge Company's bid being the lowest, it was accepted, and on the 23d day of October it entered into a con-

tract with the board of construction to complete the bridge on or before the 1st day of April, 1907.

At this time the contractor has ordered the steel; farther than that there has been nothing done.

#### FINANCIAL STATEMENT.

Appropriation.....		\$2,000 00
Advertising notice to contractors.....	\$ 3.50	
To be paid contractor on contract.....	1,975.00	
Balance in fund.....	21.50	
	\$2,000.00	\$2,000.00

#### LAS ANIMAS COUNTY BRIDGE.

Senate Bill No. 107 appropriated \$6,000.00 to be used to construct a bridge across the Las Animas river at or near the town of Sopris in Las Animas county, the exact location and the material used to be determined by the board of construction.

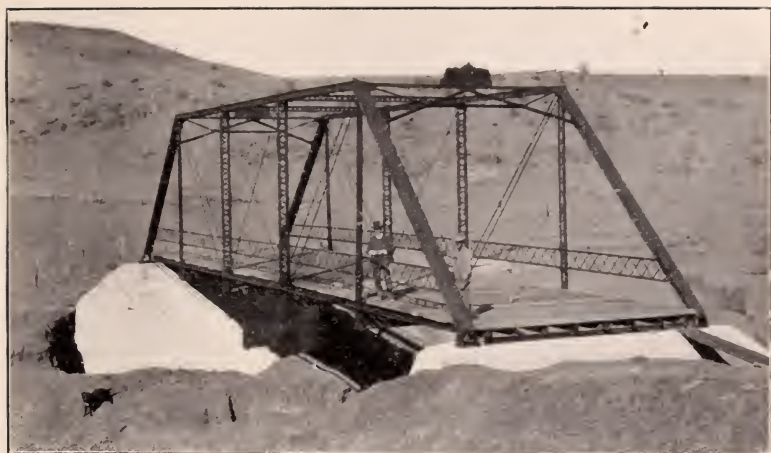
The State Engineer and the chairman of the board of county commissioners of Las Animas county (Hon. J. S. Grisham) were designated as a board of construction, whose duties would be to locate and construct the bridge.

On the 30th day of May, 1905, the board examined the river in the vicinity of Sopris and selected a site for the bridge at practically the same place that a county bridge had formerly stood and had previously been taken out by a flood. A survey was made of the river crossing. From the data obtained by the survey and the history of the flood waters which took out all the bridges along the Las Animas river for a distance of 100 miles, it was the opinion of the board that a bridge 125 feet in length, with 15 feet clearance between the bottom of the channel and the lowest parts of the superstructure should be used.

Plans and specifications were prepared for a steel pin connected Pratt truss bridge, having 7 panels, length of bridge 125 feet, height 20 feet, supported on one end by a tubular pier, constructed of two steel tubes 36 inches in diameter, connected with plate and angle web; tubes 22 feet long; inside of each tube to be three piles 10 inches in diameter, 18 feet long, driven 13 feet below the bottom of the tube. The tubes to be filled from the bottom to the top with concrete, with a concrete cap 12 inches thick on top, to which the shoes were to be anchored. The other end to be supported by a concrete abutment resting on 37 piles 16 feet long; the upper three feet to be imbedded in the concrete base.

Advertisements were inserted in one Trinidad paper, one Denver paper and in The Engineering News of New York, ask-





Sarcillo Canon Bridge, Las Animas County.



Sopris Bridge, Las Animas County.



ing that proposals for the work be submitted on or before July 29, 1905. On that date the board of construction met in the State Engineer's office and received the following bids:

The Campbell-Flagler Bridge Co., Council Bluffs, Iowa.....	\$5,090 .00
A. M. Blodgett, Kansas City, Missouri.....	4,655 .00
Minneapolis Steel & Machinery Co., Denyer, Colo.....	4,449 .00
Missouri Valley Bridge Co., Leavenworth, Kansas.....	4,441 .00
Kansas City Bridge Co., Kansas City, Missouri.....	4,290 .00
Arthur Hughes, Denver, Colorado.....	4,075 .26
Midland Bridge Co., Kansas City, Missouri.....	3,950 .00
John W. Towle, Omana, Nebraska.....	3,768 .00
The Western Engineering Co., Denver, Colorado.....	3,595 .00
Pueblo Bridge Co., Pueblo, Colorado.....	3,384 .00
Charles G. Sheely, Denver, Colorado.....	3,370 .00

Charles G. Sheely being the lowest bidder, the work was awarded to him, and on the 31st day of July, 1905, the board entered into a contract with him, whereby he was to have the bridge completed by the 1st day of February, 1906. Afterwards, owing to the contractor not being able to have his order for steel filled for six or seven months after he had given it to the mills, the time was extended to May 2, 1906. On March 15, 1906, notice was received from Mr. C. G. Sheely that he had completed the work covered by his contract and asked that a settlement be made for the same. An inspection was made by the State Engineer in person, and the work was found to be as contracted for and was accepted. On March 16, 1906, final settlement with the contractor was made. At the time the bridge was inspected by the board for acceptance, it decided to grade the approaches and to have the work cross-sectioned and let the contract by the yard. This being a small piece of work and there being an urgent demand by the people in the vicinity of the bridge to have it opened to the public, it was considered proper to let this work by private contract and not be delayed by advertising. Consequently the work was awarded to Mr. G. F. Harlon for 12½ cents per cubic yard of embankment. The county surveyor of Las Animas county, Mr. A. M. Holt, was instructed to cross-section the approaches and calculate the number of yards required in order to bring them to grade, 18 feet wide on top.

He reported 2,386.8 cubic yards, making the cost of the approaches \$298.35. On May 11 this office was notified by the Hon. J. S. Grisham that the approaches were completed. The work was inspected and settlement made October 29, 1906.

## FINANCIAL STATEMENT.

Appropriation.....		\$6,000 00
C. W. Wells, salary as deputy in charge of work.....	\$ 72 00	
C. W. Wells, expense as above.....	49.19	
Western Engineering Company, preparing plans .....	25 00	
Publishing notice to contractors.....	11 70	
Charles G. Sheely on contract .....	3,370 00	
G. F. Harlon, on contract.....	298.35	
Balance in funds.....	2,173.76	
	\$6,000 00	\$6,000 00

## CONEJOS-COSTILLA COUNTIES BRIDGE.

Senate Bill No. 340 appropriated \$7,000.00 to be used in the construction of a bridge across the Rio Grande river at the town of Alamosa, and named the State Engineer, the chairman of the board of county commissioners of Conejos county (Hon. J. B. Chapman) and the chairman of the board of county commissioners of Costilla county (Hon. W. H. Meyers) as a board of construction, whose duties were to locate and construct said bridge. The board met and decided to build the bridge on the site of the old one on the east side of the town of Alamosa. Plans and specifications were prepared for a reinforced concrete bridge and advertised May 15 in one paper in Alamosa and one paper in Denver, also The Engineering Record of New York, asking that proposals be submitted on or before June 16, 1906, for a bridge, either in accord with the plans and specifications submitted, or with plans and specifications submitted by the bidder with his proposal. On that date the board met in the State Engineer's office and was favored with the following proposals:

The Missouri Valley Bridge & Iron Works .....	\$12,800 00
The Walter Sharp Bridge Company.....	10,500 00
The Walter Sharp Bridge Company, on modified plans.....	8,500 00
The M. J. Patterson Contracting Co., on plans submitted, 3 styles of bridges, 1. .	7,800 00
2. .	8,500 00
3. .	10,000 00

The style of bridge proposed by The M. J. Patterson Contracting Company for \$7,800.00 was not considered by the board suitable for the location. Between the style proposed for \$8,500.00, the same being a steel bridge, and the style proposed by The Walter Sharp Bridge Company for the same price, it being a reinforced concrete beam bridge, the board decided that



the concrete bridge was the best proposition for the money, and the work was awarded The Walter Sharp Bridge Company, to be built after modified plans submitted with the proposal for the sum of \$8,500.00; the bridge to be 505 feet long, 16 feet wide and to have twelve 42-foot panels; the outside beams to be 56 inches high with three additional beams extending the full length of each panel, 28 inches deep by 9 inches thick. The panels to be supported at either end with reinforced concrete piers, 10 feet high,  $17\frac{1}{2}$  feet long and 16 inches thick; each pier to be supported by a base constructed of reinforced concrete, 19 feet long, 5 feet wide and 18 inches thick; this base to rest on 15 piles driven as far as possible without driving them to destruction under a 2,200-pound hammer falling 20 feet. The reinforced concrete to be composed of one part of the best Portland cement, two parts clean, sharp sand, four parts screened gravel, and about 1 per cent. of the aggregate to be the new style Johnson corrugated steel bars, placed to take care of the tension forces.

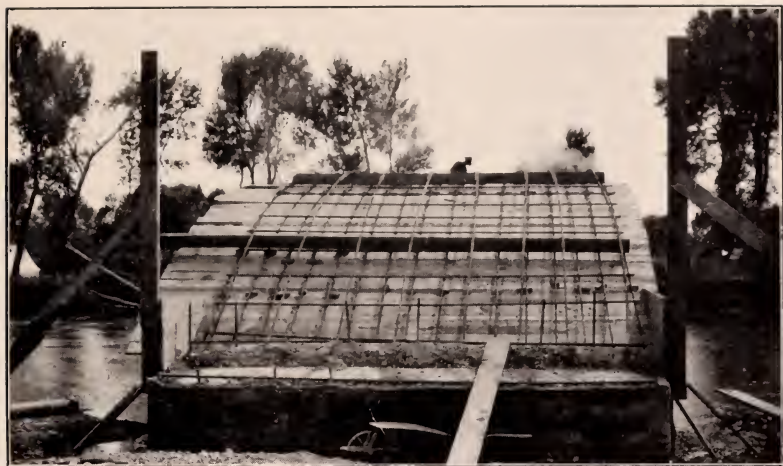
The amount of this bid being considerably in excess of the appropriation, the board of construction requested the board of county commissioners of each county interested to assist the State in the work. This the counties agreed to by passing suitable resolutions whereby each county proposed to pay to the contractor towards the construction a sum not to exceed \$1,000.00. On the 27th day of July, 1906, the board and the county commissioners of Conejos and Costilla counties entered into a contract with The Walter Sharp Bridge Company for the construction of a reinforced concrete bridge according to the modified plans and specifications for the sum of \$8,500.00, to be completed on or before the 30th day of November, 1906. Owing to the continuous high water during the summer of 1906 it was impossible for the contractor to begin work sufficiently early to be able to complete the bridge at the time specified in the contract, consequently the time limit has been extended from November 30, 1906, to July 1, 1907. This being a class of work that required extreme care during construction, P. O. Gaynor was appointed inspector; this work to be handled by him in connection with the bridge being built at Guadalupe, 30 miles below Alamosa. The work at this time is perhaps one-half completed, and will be completed next year.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$7,000.00
Appropriated by Conejos county.....		1,000.00
Appropriated by Costilla county.....		1,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 36.00	
C. W. Wells, expense on same.....	18.80	
M. S. Ketchum, report on plans.....	25.00	
Advertising notice to contractors.....	15.73	
P. O. Gaynor, inspector on work.....	42.00	
Walter Sharp, et al, on contract.....	1,000.00	
Walter Sharp, et al, to be paid on contract.....	7,500.00	
Balance in fund.....	362.47	
	\$9,000.00	\$9,000.00

## RIO GRANDE COUNTY BRIDGE.

House Bill No. 6 appropriated \$4,000.00 to be used towards constructing a bridge, and approaches thereto, across the Rio Grande river, in Rio Grande county, on the section line running north and south, between sections 33 and 34 in township 39 of range 8 east of the New Mexico Principal Meridian. This site is directly north of the Soldiers' and Sailors' Home. The State Engineer and the board of county commissioners of Rio Grande county were named as a Board of Construction. The personnel of the board for the years 1905 and 1906 was Honorables O. W. Sylvester, W. J. Clark and William Wilson. O. W. Sylvester was chairman for the year 1905 and W. J. Clark for the year 1906. An inspection was made of the site for the bridge on the 19th day of May, 1905; but on account of the swollen condition of the river at that time, it was impossible to make the necessary surveys and soundings, so the matter was deferred until a later date. The water of the river continued high until late in the summer. On the 22nd day of August, 1905, the river had subsided sufficiently to permit the surveys and soundings to be made, which was done, and it developed that a waterway 130 to 150 feet in width would be required. After fully considering all matters connected with flood waters, it was the opinion of the board that a span 150 feet long was required. Consequently plans and specifications for a combination bridge, wood and steel, 150 feet long; 16 feet roadway, to be supported by tubular piers; the tubes to be 4 feet in diameter, 19 feet 3 inches long, were prepared. On October 16th 1905, advertising was begun, asking that proposals be submitted on or before the 6th day of November, 1905. On that date, the board met in the State Engineer's office and received the following bids:



Form and Steel in Place, Monte Vista Bridge, Rio Grande County.



Forms for Reinforced Concrete Bridge, Alamosa.





John W. Towle, Omaha, Nebraska.....	\$5,240.00
The M. J. Patterson Contracting Company, Denver, Colorado.....	5,204.00
The Missouri Valley Bridge and Iron Co., Leavenworth, Kansas.....	5,170.00
C. G. Sheely, Denver, Colorado.....	4,968.00
Pueblo Bridge Company, Pueblo, Colorado.....	4,850.00

The bids submitted being considered excessive by the board they were rejected and the bidders so notified, and a modified form of plans and specifications made, preparatory to advertising again. On December 7th, notices were sent to one paper at Monte Vista and to one at Denver, asking that proposals be submitted on or before the 27th day of December, 1905. At this time contractors were asked to submit proposals on the plans and specifications furnished by the state engineer and to submit proposals for a reinforced concrete bridge on plans and specifications furnished by the bidder and to accompany the proposal. The following bids were presented and were considered by the board at a meeting held for that purpose:

The Midland Bridge Company, Kansas City, Missouri.....	\$5,125.00
C. G. Sheely, Denver, Colorado.....	4,844.00
The Western Engineering Company, Denver, Colorado.....	4,820.00
The Pueblo Bridge Company, Pueblo, Colorado.....	4,600.00
The Walter Sharp Bridge Company, Raton, New Mexico.....	4,000.00
(Reinforced concrete plans submitted with bid.)	

On the face of the proposals it appeared to the board that the Walter Sharp Bridge Company was the lowest bidder. This was for three reinforced concrete arches, two having 50 feet waterway, the third 35 feet waterway. After making an examination of the plans and specifications as to the adaptability of such a bridge for the site, the board decided to accept the Walter Sharp Bridge Company's proposal. To accept this proposal, however, would absorb all the State money and leave nothing to take care of the necessary expenses. As a consequence, a request was made on the commissioners of Rio Grande county to pledge the county for the amount of the estimated expenses that would be incurred in the construction of the bridge. On the 19th day of March the commissioners of the county passed suitable resolutions agreeing to contribute \$760 toward the construction of the State bridge. The board having been previously informed by the commissioners that such a resolution would be passed, had entered into a contract, jointly with the commissioners, with The Walter Sharp Bridge Company for the construction of the bridge, the county to pay the said \$760; the bridge when completed to cost \$4,000.00 and the wing

walls to cost \$260.00, making a total of \$4,260.00; to be completed in all respects on or before the 10th day of September, 1906. In order that a good check might be kept on the quality and quantity of the materials used, Mr. P. O. Gaynor was appointed inspector.

During the summer of 1906, the Rio Grande continued high for a much longer time than had been experienced for the same season in past years. As a result the contractor could not begin work until the middle of August, and before the bridge could be more than half completed, the weather had begun to be so severe that it was impossible to place cement and the work has been suspended until spring sets in. The contractor's time has been extended until July 1st, 1907.

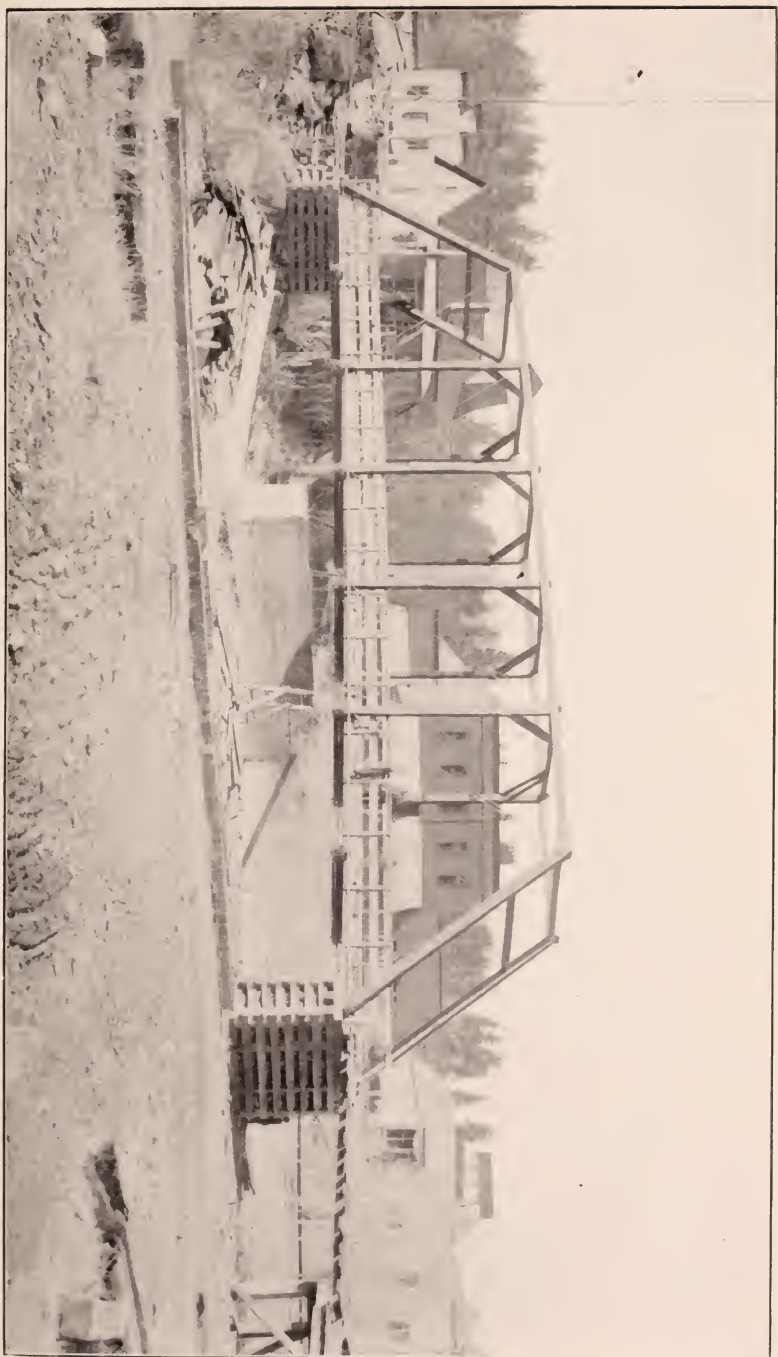
This bridge, when completed, will be composed of reinforced concrete, one part best Portland cement, two parts clean, sharp sand and four parts screen gravel; approximately 1% of the aggregate will be the New Style Johnson Corrugated steel bars, placed to take care of the tensile forces. The 50 feet arches will have a rise above the spring line of 9 feet, and the 35 feet arch will have a rise above the spring line of 9 feet 3 inches. Above the rings of the arches are suitable spandrel walls with copings and guard rails.

#### FINANCIAL STATEMENT.

Appropriated by state.....		\$4,000 00
Appropriated by Rio Grande county .....		760 00
C. W. Wells, salary while in charge of work as deputy.....	\$ 72.00	
C. W. Wells, expense as above.....	24.63	
Advertising for proposals .....	21.60	
C. W. Raynor, preparing plans for combination bridge.....	50.00	
M. S. Ketchum, report on reinforced concrete plans. ....	25.00	
Walter Sharp Bridge Company, pledged.....	4,260.00	
P. O. Gaynor, inspector.....	186.00	
Balance in fund unpledged.....	120.77	
	\$4,760.00	\$4,760 00

#### ARCHULETA COUNTY BRIDGE.

House Bill No. 229 appropriated \$3,000.00 to be used to construct a bridge across the San Juan river at the city of Pagosa Springs, in Archuleta county. The Governor, State Engineer and the chairman of the board of county commissioners of Archuleta county, were named as a board of construction. An inspection was made of the possible sites in the town of Pagosa Springs and the site of the old bridge was selected as the logical location for the new bridge. At this time the county



Combination Steel and Wood Bridge, Pagosa Springs.





surveyor of Archuleta county, Mr. R. A. Howe, was instructed by the county commissioners to make the necessary surveys and furnish all data of the river at the site, needed in order to plan the proper kind and size of bridge. This was done and it was some time before the board fully decided as to what kind of a bridge they would build. They finally, early in the summer of 1906, decided to construct a steel and wood combination Pratt truss bridge, 128 feet long, 22 feet high, 14 feet roadway, supported by crib abutments filled with stone. All wood to be red spruce or native yellow pine. On the 29th day of June advertising was begun in one paper at Pagosa Springs and one paper in Denver asking that proposals be submitted on or before July 21st, 1906. On that date the board met and received the following bids:

The Midland Bridge Company, Kansas City, Missouri.....	\$2,999.00
The Pueblo Bridge Company, Pueblo, Colorado.....	2,870.00

The Pueblo Bridge Company being the lowest bidder, the work was awarded to it and on the 8th day of August, 1906, the board entered into a contract for the bridge to be constructed for \$2,870.00, to be completed on or before the 1st day of November, 1906. At the time the contractor placed his order for the steel to be used in the bridge, it was learned that it would be impossible to have the order filled sufficiently early to permit the bridge to be completed at the date stipulated, and an extension of time was given by the board until the 31st day of December, 1906. On the 26th day of December notice was given by the contracting company that the bridge was completed, and on the 29th day of December, 1906, the work was inspected and accepted and settlement made.

## FINANCIAL STATEMENT.

Appropriated.....		\$3,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 18.00	
C. W. Wells, expense while looking after same.....	6.55	
Advertising for bids.....	4.65	
Pueblo Bridge Company on contract.....	2,870.00	
Balance in account.....	100.80	
	\$3,000.00	\$3,000.00

## LAS ANIMAS COUNTY BRIDGE.

House Bill No. 381 appropriated \$2,000.00 to be used to construct a bridge across the Sarcillo Canon Arroyo in Las Animas county, to be situate on the southeast  $\frac{1}{4}$  of the southeast  $\frac{1}{4}$  of Sec. 34, T. 33 S., R. 66 W., of the 6th P. M.

The county surveyor with the board of county commissioners of Las Animas county were constituted a board, whose duty it was to construct the proposed bridge.

On the 17th day of May, the board met in Trinidad, the board consisting of County Commissioners J. S. Grisham, E. A. Duling and J. V. Vigil, and County Surveyor A. M. Holt. It was decided that a steel span 80 feet long, 16 feet roadway and stone or concrete abutments should be constructed, bidders to submit plans and specifications with their bids; time for receiving bids to end June 7, 1905, at 10 a. m.

The board decided that the plan presented by the Pueblo Bridge Company for \$2,000.00, was the best bridge offered, and the work was awarded to it, and contract entered into; the work to be completed on or before the 7th day of October, 1905.

Early in March, 1906, notice was received from the contractor that the bridge was completed, and asked that it be inspected. An inspection was made at once and on the 20th day of March, the Auditor was notified of the result of such examination and full settlement made.

#### FINANCIAL STATEMENT.

Appropriation.....		\$2,000 .00
The Pueblo Bridge Company on contract.....	\$2,000 .00	
	\$2,000 .00	\$2,000 .00

#### ROUTT COUNTY BRIDGE.

Senate Bill No. 35 appropriated \$5,000.00 to be used to construct a wagon bridge across the Yampa river in Routt county, at Fraker Ford, the exact location and the kind of material to be used to be determined by the board of construction named by the terms of the act.

The Governor, State Engineer and the chairman of the board of county commissioners of Routt county (Hon. R. W. Finley), were to constitute the board of construction.

On the 14th day of April, 1905, the site at Fraker Ford was inspected by a representative from this office, but owing to the river being high, it was impossible to make the necessary surveys, to fully determine the length of bridging required or the character of the material to be encountered in putting down the substructure. From the information gathered, it became apparent that the State fund would not be enough to construct the bridge. These matters were communicated to the county commissioners, and they were asked to take proper steps toward assisting the State fund. On July 3, 1905, the county commissioners passed a resolution agreeing to take care of whatever deficiency there might be

after the State fund was exhausted. On August 30, 1905, the chairman of the board of county commissioners was requested to have the county surveyor make the required surveys of the site at Fraker Ford and send to this office the notes. After this was done, it was decided to build a steel and wood combination bridge on stone abutments. The county commissioners to construct the abutments and piers, after which the board of construction would build the superstructure. On the 17th day of October notice was received from the county surveyor of Routt county, that he had made a survey of the site, had staked out the abutments and pier and that the work was in progress; also sending field notes and plans of abutments and pier. From the notes it was apparent that two spans, each 128 feet in length would be required; therefore, plans and specifications were prepared at once for a bridge to consist of two Pratt truss spans, 14 feet wide, 128 feet in length between centers, 22 feet in height. On the 12th day of December advertising was begun in one Routt county paper and in one Denver paper, asking for bids to close January 6, 1906. On that date the board met and opened the following proposals:

Chas. G. Sheely, Denver, Colorado.....	\$6,287 .00
The Pueblo Bridge Company, Pueblo, Colorado.....	6,425 .00

It was estimated that \$4,700.00 of the State fund would be available for construction purposes. It would require the county to pay, if the lowest of the two bids was accepted, the sum of \$1,600.00. The matter of accepting was referred to the county commissioners with recommendations. They requested that all bids be rejected and that advertisements be deferred until the summer of 1906. On April 26, 1906, advertising for bids was begun in one paper at Craig, Routt county, and in one Denver paper, asking that proposals be submitted on or before the 26th day of May, 1906, either on the plans and specifications for a combination steel and wood bridge, prepared by the State Engineer, or upon plans and specifications submitted with the proposal. Such plans submitted by the bidder to be for a steel bridge or a combination bridge of steel and wood. On that date the board met and received the following bids:

The M. J. Patterson Contracting Company, Denver, Colorado, steel bridge, plans submitted with bid.....	\$6,497 .00
Hunt & Taylor, Craig, combination bridge.....	5,200 .00
The M. J. Patterson Contracting Company, Denver, combination bridge....	4,917 .00
C. G. Sheely, Denver, Colorado, steel bridge, plans submitted with proposal...	6,000 .00

It being the wish of the county commissioners that a steel bridge be constructed, the proposal of C. G. Sheeley to construct two Pratt truss steel spans, each 128 feet long, 22 feet high, 14 feet wide; all lumber for joists, floor, etc., to be of native red spruce, for the sum of \$6,000.00 was accepted; a contract was entered into by him, with the board of construction and the board of county commissioners for such bridge, to be completed on or before the 1st day of January, 1907. On the 10th day of January, 1907, notice was received from the contractor that he had completed his work, and asked that it be inspected, accepted and payment made for the same. On the 15th day of February, 1907, the bridge was examined and on the 26th day of February settlement was made in full.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$5,000.00
Appropriated by county (estimated).....		2,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 36.00	
C. W. Wells, expense as above.....	21.15	
Advertising notice to contractors.....	12.43	
C. G. Sheeley, on contract .....	6,000.00	
Cost of abutments and pier.....	900.00	
Balance in fund.....	30.42	
	\$7,000.00	\$7,000.00

## CLEAR CREEK COUNTY ROAD.

Senate Bill No. 156 appropriated \$2,500.00 to be used to construct a wagon road from a point at or near the town of Alice, Clear Creek county, to the town of Dumont, in said county.

The State Engineer and the board of county commissioners of Clear Creek county (Frank A. Maxwell, Thomas Coppard and W. H. Jones), were named as a board whose duties were to locate, construct and repair the proposed road. Early in April, 1905, Mr. Geo. R. Stuart, manager of the Puritan mine, of Alice, Colorado, called on the State Engineer in the interest of this road. He had previously made a preliminary survey of a proposed route for the road and asked that his work be inspected and if approved he would then do whatever work was required, as an engineer, to make the preliminary line permanent. On the 26th day of May an inspection of the proposed route was made and the route and survey as proposed by Mr. Stuart was accepted and instruction given regarding additional information, the notes of which were received June 4, 1906. On June 13, 1906, advertising for bids was begun in one Clear Creek county paper. The expiration of the time for receiving bids was fixed at July 1, 1906. On



that date the board met and were favored with the following bids: A. H. Wood and C. E. Noyes, Idaho Springs, Colorado; from station 0 to station 220, being 22,000 lineal feet, for \$3,000.00. Chas. Heckman, of Empire, Colorado; station 0 to station 230, being 23,000 lineal feet, for \$2,900.00.

Both bids were in excess of the appropriation, but the Colorado Southern Railroad had previously made a donation to the fund of \$500.00, making available for the construction of the road \$3,000.00. Mr. Heckman's bid being the lower, the board agreed to award him the work providing the local parties would construct the remaining 3,225 feet of road. This they agreed to do, and Mr. W. P. Alkire submitted a proposal to do the 3,225 lineal feet for one dollar. This proposition was accepted, and on the 13th day of July the board entered into contract with him to do that amount and to have the work completed on or before October 15, 1905.

The board entered into contract with Charles Heckman to build from station 0 to station 230 for \$2,900.00; to have the work completed on or before the 15th day of October, 1905. On November 1, notice was received from each contractor that they had completed their respective pieces of the road. An inspection was made by the board. On November 13, 1906, settlement in full was made.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$2,500.00
Donated by Colorado & Southern railroad.....		500.00
C. W. Wells, salary as deputy in charge of road.....	\$ 48.00	
C. W. Wells, expense as deputy in charge of road.....	19.63	
A. K. Vickery, engineer on estimate.....	12.00	
Publishing notice to contractors.....	1.76	
Thomas Coppard, 1 day inspecting road.....	5.00	
W. H. Jones, 1 day inspecting road.....	5.00	
Frank A. Maxwell, 1 day and expense, inspecting road.....	5.60	
Chas. Heckman, on contract.....	2,900.00	
W. P. Alkire, on contract.....	1.00	
Balance in fund.....	2.01	
	\$3,000.00	\$3,000.00

## BENT COUNTY ROAD.

House Bill No. 132 appropriated \$3,000.00 to be used in improving the public county road, beginning at the north boundary line of the town of Las Animas, Bent county, thence north to near the south line of T. 22, R. 53, W. of the 6th P. M., thence running east and west in Sec. 3, T. 23 S., and Sec. 34, T. 22 S.

The State Engineer and the board of county commissioners of Bent county were named as a board whose duties would be to determine the character of improvements to be made and the manner in which the work connected with such improvements, should be done. In the latter part of April, 1905, the board of construction held a meeting and it was the opinion of the board that the money appropriated by the State should be used in putting surfacing on the road to be bettered; the county commissioners agreeing to do all grading required to form a proper base for shale covering. Specifications were prepared, and after the county commissioners had done the grading required, advertising for bids was begun, asking that proposals be submitted on or before September 16, 1905. On that date the board was favored with bids as follows: S. C. Riley, Las Animas, Colorado: All work done south of the Arkansas river as per specifications, 22½ cents per square yard of surface covered; all work done north of the Arkansas river as per specifications 32½ cents per square yard of surface covered; all that portion specified to be done by the cubic yard, material measured in wagon box, \$1.10 per cubic yard. John Dwyer, Las Animas, Colorado: All work done south of the Arkansas river as per specifications, 20 cents per square yard of surface covered; all work done north of the Arkansas river as per specifications, 30 cents per square yard of surface covered; all that portion specified to be done by the cubic yard, material measured in wagon box, \$1.10 per cubic yard.

The work was awarded to John Dwyer and a contract was entered into with him for the work to be completed on or before the 31st day of December, 1905. Mr. G. W. Kinsley of Las Animas was appointed inspector. On the 11th day of January, 1906, notice was received that the contractor had finished all work covered by the terms of his contract, namely \$2,750.00 worth. An inspection was made on the 23rd day of January, 1906, and the work was found to conform with the requirements of the specifications and final settlement was made accordingly. There being additional money in the fund, the contractor was instructed to do extra work to be paid for under the provisions of the contract per cubic yard. After final completion, the following work had been done. From the bridge across the Arkansas river running north 338 lineal feet, 16 feet wide, covered 7 inches deep; east and west along the township line approximately 3010 lineal feet, 16 feet wide, covered 9 inches deep; from the south line of Las Animas to the river bridge, 1880 lineal feet, 20 feet wide, 9 inches deep. On January 24th, 1906, final settlement was made for the work.

## FINANCIAL STATEMENT.

Appropriation.....		\$3,000 00
C. W. Wells, salary as deputy in charge of work.....	\$ 18 00	
C. W. Wells, expense as deputy in charge of work.....	15 43	
C. W. Beach, salary for inspection trips.....	30 00	
C. W. Beach, expense for inspection trips.....	12 80	
Advertising notice to contractors.....	1 76	
John Dwyer, on contract.....	2,892 57	
Balance in fund.....	29 44	
	\$3,000 00	\$3,000 00

## BOULDER-GRAND COUNTIES WAGON ROAD.

House Bill No. 163 appropriated \$5,000.00 to be used in constructing a wagon road from the town of Eldora, running thence westerly eight miles to what is known as Arapahoe Pass, and thence from Arapahoe Pass in a westerly direction down into Grand county, a distance of twelve miles.

The State Engineer, the chairman of the board of county commissioners of Boulder county, (Hon. Nicholas R. Herival) and the chairman of the board of county commissioners of Grand county (Hon. Edmund Becker), were constituted a board of construction.

At the beginning of the present administration the State Engineer was given notice by the Auditor that there would be \$75,000 available in the Internal Improvement Permanent and Income Funds for the year 1905. As far as possible the State Engineer allowed those roads and bridges to have preference which seemed to be the most needed, and for which there were the most urgent demands, at the same time looking to the geographical location and giving each section of the State a portion of such available money. As a consequence, nothing was done toward this road until the spring of 1906.

Late in June, 1906, Mr. Horace C. Hall, of Boulder, was employed to make a survey of that portion of the road located in Boulder county. He completed the work and sent in his notes on the 16th day of July. His survey was divided into three sections, as follows: First, Known as the Hesse hill, a distance of 2,700 lineal feet; second, Denver hill, a distance of 1,000 lineal feet; third, from the Fourth of July mine to Arapahoe pass, a distance of 2,900 lineal feet. This survey was accepted, and on August 1 a notice was placed in an Eldora paper asking that bids be submitted on or before August 18, 1906, for the work as surveyed. On that date the board met and the following proposals were presented:

Nels Jacobsen, Gold Hill, Colorado—Hesse hill, \$2,300; Denver hill, \$275, and Fourth of July mine section, \$1,400; the entire work, \$3,975.

Hendry Johnson, Boulder, Colorado—Hesse hill, \$2,200; Denver hill, \$275, and Fourth of July mine section, \$1,400; the entire work, \$3,900.

Hendry Johnson's bid was the lowest, but to do the entire amount of work laid out it exceeded one-half of the appropriation, the amount it was considered Boulder county was rightly entitled to; and either Grand county would have to relinquish its claim to the amount required in excess of the one-half or a portion of the work would have to be dropped. On September 6th Mr. Becker wrote, expressing a willingness on the part of Grand county to allow the full amount of the appropriation to be used in Boulder county. On the 22d day of September, 1906, a contract was entered into between the board and Hendry Johnson for the full amount of work covered by his proposal, to be completed on the 30th day of November, 1906. The contractor succeeded in doing the work at Hesse hill and at Denver hill, and about one-half of the work of the Fourth of July mine section, but owing to the early snow storms he was unable to complete the work and was granted an extension of time until the 1st day of August, 1907. When this contract is completed it will give as good a road as the requirements demand from Eldora to Arapahoe pass, and the money still in the fund after all obligations are met can either be expended on the western slope end of the road or turned back, as the Legislature may see fit.

#### FINANCIAL STATEMENT.

Appropriation.....		\$5,000. 00
H. C. Hall, surveying road.....	\$ 70. 50	
John Manning, notice to contractors.....	1. 76	
Hendry Johnson, paid on contract.....	2,240. 00	
Hendry Johnson, to be paid on contract.....	1,660. 00	
Balance in fund unpledged.....	1,027. 74	
	\$5,000. 00	\$5,000. 00

#### EL PASO-TELLER COUNTIES ROAD

House Bill No. 249 appropriated \$3,500.00 to be used to repair and improve generally the wagon road from Colorado Springs, El Paso county, to Cameron, Teller county, via Cheyenne canon.

The State Engineer, the chairman of the board of county commissioners of El Paso county (Hon. F. L. Rouse), and the chairman of the board of county commissioners of Teller county



(Hon. W. E. Meek) were constituted a board, whose duties were to view, repair and improve the road. All surveys were to be made by the county surveyor of Teller county, working under instructions from the State Engineer.

As soon as the season opened in the spring of 1906 attention was directed to it, and on June 14, 1906, the board made a trip over the road for the purpose of viewing it and deciding what had best be done. After fully inspecting the road between the initial points, the distance being 35 miles, the board concluded that the proper thing to do would be to divide the money equally between the counties, using Teller county's portion to repair the road, beginning at Cameron and working toward Colorado Springs, as far as the money would go. With this object in view, it was decided to make a survey from the county line, between Teller and El Paso counties, to the town of Cameron, taking note of repair work needed. With El Paso county's portion of the money the board concluded that the best that could be done would be to start at the point where the old road leaves Cheyenne mountain and construct a new road 12 feet in width, with a maximum grade of 10 per cent. toward Colorado Springs. The proper instructions covering the work agreed upon by the board were given to the county surveyor of Teller county, Mr. Geo. H. Atherton, who placed Mr. L. J. Carrington, of Woodland Park, in charge of the Teller county work, and Mr. W. P. Woodside, of Colorado Springs, in charge of the El Paso county work. By November 1, 1906, complete notes of the surveys had been returned to this office, and a notice was placed in one Colorado Springs paper and one Cripple Creek paper asking that proposals be submitted for the work in each county separately, on or before the 30th day of November, 1906. On that day the following bids were delivered to the State Engineer: For the Teller county portion one bid was submitted, Mr. H. L. Boynton, of Victor, Colo. From station 0 to station 698, a distance of 69,800 lineal feet, \$3,500.00. From station 698 back to station 480, a distance of 21,800 lineal feet, \$1,500.00.

For the El Paso county portion two bids were submitted. Mr. Hendry Johnson, of Boulder, Colo.: All work covered by the profile, being for 8,725 lineal feet of new road, \$3,355.00. Mr. H. T. Craig, of Denver, Colo., for the same amount of road as covered by Mr. Johnson's bid, \$1,550.00. The board considered that the bids of Mr. H. L. Boynton, proposing to construct 21,800 feet of the Teller county end for \$1,500.00 and the bid of Mr. H. T. Craig, proposing to construct all of the El Paso county end for \$1,550.00 were reasonable, but owing to the lateness of the season nothing has been done.

## FINANCIAL STATEMENT.

Appropriation.....		\$3,500.00
C. W. Wells, salary as deputy in charge of work.....	\$ 6.00	
C. W. Wells, expense as deputy in charge of work.....	.50	
W. J. Elliott, livery hire.....	20.00	
J. S. Gorham, livery hire.....	8.00	
Notice to contractors.....	12.52	
L. J. Carrington, surveying Teller Co. end.....	220.32	
W. P. Woodside, surveying El Paso Co. end.....	202.00	
Balance in fund.....	3,030.66	
	\$3,500.00	\$3,500.00

## THE GARFIELD-RIO BLANCO AND ROUTT COUNTIES ROAD.

Senate Bill No. 1 of the Twelfth General Assembly provided for a State road from Denver, Arapahoe county, to Grand Junction, Mesa county, and certain branch roads thereto; branch No. 2 being from the town of Rifle, Garfield county, to the town of Craig, Routt county, via Meeker, Rio Blanco county, "the most practicable route and the more definite location of said road and the branches thereof along the general course above indicated shall be determined by the State Engineer, and which route shall, so far as practicable, be along the lines of regularly established and existing county roads."

The Governor, the State Engineer and the chairman of the Board of County Commissioners of each county traversed by the road were to constitute a board of construction for that portion of the road lying within the boundary of such county.

House bill No. 2 appropriated \$6,000.00 to be used in constructing, improving and repairing branch No. 2 of the wagon road as proposed and provided for in Senate Bill No. 1, approved May 3, 1899.

On April 12, 1905, an inspection was made of the work needed to be done between Rifle and Meeker. On the 18th day of May, 1905, Mr. A. K. Vickery commenced a survey of the same, which was completed June 2, 1905. On June 20th a notice was inserted in one Glenwood Springs paper and one Meeker paper asking that proposals be submitted for four miles of work in Garfield and four miles of work in Rio Blanco county, bids to be in on or before July 5th, 1905. On that date the board was favored with one bid, being from Mr. F. P. Caldwell for the portion in Rio Blanco county, for the sum of \$2,750.00. The board not caring to award on one bid, the proposal was rejected, and another notice inserted in the same papers asking that bids be submitted on or before July 21, 1905. On this date the following proposal was filed with the State Engineer:



Log Bridge, Rifle-Meeker Road, Rio Blanco County.



Forty-Foot Log Bridge, Willow Creek, Grand County Road.





Garfield county portion:	
Hendry Johnson.....	2,775.00
Rio Blanco county portion:	
Hendry Johnson.....	2,775.00

Again having but one bid for the work it was rejected, and nothing more was done until March 26, 1906, when a notice was inserted in one paper in Denver, Colorado Springs, Rifle and Meeker, asking that proposals be submitted on or before April 30, 1906. The following were received on that date.

Garfield county portion:	
T. D. Squires, Rifle, Colorado.....	\$3,400.00
Charles W. Fravert, Rifle, Colorado.....	2,935.00
Hugh O'Neil, Meeker, Colorado.....	2,225.00
Rio Blanco county portion:	
Hugh O'Neil.....	2,848.33
Charles W. Fravert.....	2,632.00

Mr. O'Neil being the lowest bidder for the Garfield county portion and Mr. Fravert for the Rio Blanco county portion, the work was awarded them accordingly, and contracts entered into, Mr. O'Neil to complete his work on or before October 10. His time was extended, however, until December 1, 1906, at which time notice was given that he had completed the work. Mr. Fravert was to complete his work by August 11, 1906. On July 21, 1906, notice was received that he had completed and asked that it be inspected and final settlement made. On the 5th day of August the work was inspected and on August 10, 1906, Mr. Fravert was paid in full for all work under the contract. Final settlement has not been made with Mr. O'Neil.

There was still a considerable portion of the appropriation left and it was the opinion of the Governor and State Engineer that this should be used between Meeker and Craig. The point that mostly appealed to them as needing attention was what is locally known as Williams Fork Hill, near the postoffice of Hamilton, Routt county, and Mr. W. P. Finley of Craig was employed June 25, 1906, to make the necessary surveys. The survey being completed by August 1st, a notice was inserted in one paper at each of the following places: Denver, Colorado Springs and Craig, asking that bids be submitted up to September 1, 1906. On that date the board met and received the following bids:

Thomas Hamilton, Hamilton, Colorado:		
Section 1. William's Fork Hill, 4,000 feet long.....	\$650 .00	
Section 2. Along William's Fork river, Pitchfield Place, 1,050 feet long.....	375 .00	
For the entire work as specified.....		\$1,025 .00
George Pitchfield, Hamilton, Colorado:		
Section 1. As above.....	675 .00	
Section 2. As above.....	325 .00	
For the entire work as specified.....		\$1,000 .00

For the entire work advertised, the bid of George Pitchfield was the lower, but at this time there remained but \$803.00 in the fund, which made it impossible to do any more than section No. 1. On this section Mr. Hamilton's proposal was the lower and the work was awarded him. A contract was entered into, the work to be completed on or before November 30, 1906. On that date notice was received that the work was completed.

A summary of the work done in this case is as follows: Beginning at mile post 14, on the Rifle-Meeker road up Government creek, a new road, 12 feet road bed, maximum grade 8 per cent. was constructed on the side hill to the east of the old road for a distance of 4 miles to the divide between Grand and White rivers, approximately the county line between Garfield and Rio Blanco counties. Beginning at a point 3 miles from the above divide in Rio Blanco county,  $\frac{1}{4}$  mile south of crossing of Piceance creek, graded up old road to a 12 feet road bed, built new bridges and drain boxes to within 12 miles of the town of Meeker, being a distance of 6 miles. Beginning at top of Williams Fork Hill, built a new road to the bottom, 10 feet road bed, maximum grade 8 per cent.



Hell-Gate, Six Miles West of Glenwood Springs.



Old Bridge, Built 1884—Canon Creek, Garfield County.





## FINANCIAL STATEMENT.

Appropriation.....		\$6,000 00
C. W. Wells, salary as deputy in charge of work .....	\$ 60 00	
C. W. Wells, expense as deputy in charge of work.....	33 90	
A. K. Vickery, salary, charge of survey.....	84 00	
A. K. Vickery, expense, in charge of survey.....	75 30	
W. P. Finley, account surveying.....	38 00	
A. E. Rees & Sons, livery.....	24 00	
Publishing notice to contractors.....	29 82	
Chas. W. Fravert, on contract.....	2,632 00	
Hugh O'Neil, on contract, pledged.....	2,225 00	
Thos. Hamilton, on contract, pledged.....	650 00	
Balance in fund.....	147 98	
	\$6,000 00	\$6,000 00

## EAGLE AND GARFIELD COUNTIES ROAD.

Senate Bill No. 1 of the Twelfth General Assembly provided for a State road (see Garfield, Rio Blanco and Routt counties road, page 92).

Senate Bill No. 168 appropriated \$5,000.00 to be used for further construction, widening and improving the State wagon road from the City of Denver to the City of Grand Junction, which road was established by an act entitled "An act to construct, improve and repair a State wagon road from the City of Denver, Arapahoe county, to the City of Grand Junction, Mesa county, Colorado, with certain branch roads therefrom," approved May 3, 1899.

All work was to be done under a board of construction, as provided for in the said act and in the same manner and under the same authority as the original construction of the road.

The specified portion to be considered at this time was between Tennessee Pass, in Eagle county and the Town of De Beque, in Mesa county. On the 4th day of May, 1906, the State Engineer had the road inspected between the initial points to ascertain where and how the money had best be used. In Eagle county Hon. John F. McCoy, county commissioner, assisted in the inspection. In Garfield county the entire board of county commissioners assisted, the board consisting of the Honorables A. P. Ralston, chairman, James Brennan and H. C. Jessup. The Hon. John Ault was chairman of the board of county commissioners of Eagle county. As a result of the trip of inspection, it was decided to use the money in the following places, and in the event that the money would not complete all the work outlined, the sections would be dropped in the same order as herein given.

all road work to be new and none of the money to be used to repair old work. On the 4th day of May a survey was started by Deputy State Engineer C. W. Wells of the places designated:

1. At a point 2 miles west of the town of Minturn, 1,400 feet of road.

2. At point just west of Squaw creek and Hawley's ranch, 2,500 feet of road.

3. At a point  $\frac{1}{4}$  mile west of the town of Wolcott, 3,200 feet of road.

4. A point 5 miles east of the town of Eagle at Otega Siding, 2,800 feet of road.

5. At a point 6 miles west of Glenwood Springs, known as Hell Gate, 1,450 feet of road.

6. A reinforced concrete bridge across Canon creek, 8 miles west of Glenwood Springs, 30 feet span.

7. At a point 6 miles west of the town of Rifle at what is known as Webster Hill, 2,450 feet of road.

All of the above was laid out with a maximum grade of 8 per cent. On June 29 a notice was inserted in one paper in each of the following places, Denver, Glenwood Springs, Eagle and Rifle, asking that proposals be submitted on or before August 1, 1906, for the above work. On that date the board was presented with the following proposals:

Craig & Hinkel, Denver, Colorado:	
Section No. 1. Minturn.....	\$ 700.00
Section No. 2. Squaw Creek.....	900.00
Section No. 3. Wolcott.....	500.00
Section No. 4. Otega Siding.....	500.00
Section No. 5. Hell Gate.....	1,200.00
Section No. 7. Webster Hill.....	700.00
E. L. House, Rifle, Colorado:	
Section No. 7. Webster Hill.....	790.00

The Knowlton & Bollen Construction Company, Fort Collins, Colorado, Sections 1-2-3-4-5-7:

Earth.....	\$ .35 per cubic yard.
Loose rock.....	.65 per cubic yard.
Solid rock.....	1.35 per cubic yard.
Surfacing.....	.10 per square yard.
Embankment borrowed.....	20 per cubic yard.
Retaining wall.....	2.00 per square yard.
Clearing and grubbing.....	40.00 per acre.
Culverts, 1x1.....	.60 per lineal foot.
Culverts, 2x2.....	1.00 per lineal foot.
Culverts, 3x6.....	1.50 per lineal foot.

On Section 6. Bridge across Canon Creek:

C. G. Sheely, Denver, Colorado.....	\$1,290.00
Pueblo Bridge Company, Pueblo, Colorado.....	1,425.00
The Midland Bridge Company, Kansas City, Missouri.....	1,800.00
The Walter Sharp Bridge Company, Raton, New Mexico.....	995.00

Contracts were entered into between the different boards of construction and the firm of Craig and Hinkel for sections 2, 3, 4, 5 and 7 for a total sum of \$3,800.00, to be completed on or before November 30, 1906. At that time notice was received from the contractor that he had completed, and on the 12th of January, 1907, a final inspection was made, the work accepted and the contractor settled with in full.

Section No. 6, being the reinforced concrete bridge at Canon Creek, the board of construction awarded to the Walter Sharp Bridge Company, it being the lowest bidder, and a contract was entered into, whereby the bridge was to be completed on or before the 30th day of November, 1906. On that date notice was given by the contractor that the bridge had been completed. On January 12, 1907, it was inspected and accepted and final settlement made.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$5,000 00
Appropriated by Garfield county.....		25 00
C. W. Wells, salary as deputy in charge of work.....	\$ 90 00	
C. W. Wells, expense as deputy in charge of work.....	90 20	
Peter O'Brien, assistant on survey.....	22 00	
Publishing notice to contractors.....	19 53	
Craig & Hinkel, on contract.....	3,800 00	
Walter Sharp Bridge Co., on contract.....	995 00	
Balance in fund.....	8 27	
	\$5,025 00	\$5,025 00

## DOUGLAS COUNTY ROAD.

House Bill No. 382 appropriated \$3,000.00 to be used for the repair and general improvement of the county road from the north line of Douglas county, thence along the course of the Denver and Rio Grande Railroad to the town of Sedalia, Douglas county. The State Engineer, the county commissioner of the third commissioners' district of Douglas county (Hon. R. P. Bean), and the county surveyor of Douglas county (George P. Stewart), were designated as a board of construction, under whose supervision the selection of the places to be improved, as well as the class and quality of improvements, were placed. After the work had been inspected, the county surveyor of Douglas county, working under the direction and instruction of the State Engineer, was named to make all needed surveys. On the 3rd day of October, 1906, the board of construction, accompanied by Representative Alfred Stewart, inspected the road as laid out in the act, and decided that the money appropriated could be best used by constructing some needed bridges. Two sites were selected on which to place improvements; one site one-fourth of a mile south of the county line, at a point where there is now a 70-foot wooden bridge, a 30-foot reinforced concrete bridge with suitable earth approaches, is to be built; and at a point about one mile farther south, at what is known as Spring Creek, a 10-foot culvert 7 feet high is to be built and suitable earth embankments graded over it. On October 4, 1906, a notice was inserted in one Denver paper and one Castle Rock paper, asking that proposals be submitted for this work on or before November 3, 1906. At that time the board met and was favored with the following bids:





Forms and Steel in Place, Canon Creek Bridge, Garfield County.



Thirty-foot Reinforced Concrete Bridge, Canon Creek, Garfield County.



The Denver Bridge Company, Denver, Colorado:	
For the bridge.....	\$2,795 .00
For the culvert.....	1,225 .00
For the grading, per cubic yard.....	.25
C. G. Sheely, Denver, Colorado:	
For the bridge.....	\$2,695 .00
For the culvert.....	1,175 .00
For the grading, per cubic yard.....	.25

All bids appearing to be excessive, they were rejected and new plans prepared. Nothing further will be done until the season opens again in the spring.

## FINANCIAL STATEMENT.

Appropriation.....		\$3,000 .00
C. W. Wells, salary as deputy in charge of work.....	\$ 6 .00	
Advertising notice to contractors.....	5 .89	
Balance in fund.....	2,988 .11	
	\$3,000 .00	\$3,000 .00

## EAGLE COUNTY ROAD.

House Bill No. 21, passed by the Fourteenth General Assembly, appropriated \$5,000.00 to be used in constructing a wagon road from the town of Basalt up the Frying Pan river to the railroad station of Ruedi, Eagle county. The Governor, State Engineer and chairman of the board of county commissioners were named as a board of construction, whose duties were to have supervision over all things connected with the road. This road had been surveyed by my predecessor, but nothing further had been accomplished. At the beginning of the present administration there was a balance of \$3,750.37 still in this fund. House Bill No. 88 appropriated \$5,500.00 to be used towards the construction of a road along the same route. The State Engineer, the chairman of the board of county commissioners of Eagle county (Hon. John Ault), and the mayor of the town of Basalt (Hon. W. W. Fry), were designated as a board to construct the road. This board differed somewhat from the one previously named; still the State Engineer and the chairman of the board of county commissioners were members of each body, and it was left to them to look after the construction in general. The two appropriations gave \$9,250.37 available money for the project, and on April 25th a notice was inserted in one paper in Basalt and one paper in Denver asking that proposals be submitted for 19 miles

of road work from Basalt to Ruedi on or before May 22, 1905. This date was afterwards changed to June 5, 1905. On that date the board received but one bid.

M. A. Anderson proposed to build the road for the sum of \$12,950.00. This being much in excess of the amount of money available, the proposal was rejected. On August 8th, 1905, the board of county commissioners of Eagle county passed a resolution appropriating \$4,000.00 to be used in assisting the State fund in building the Basalt-Ruedi road, to be paid in installments of \$1,000.00 per year until paid. On August 11th Messrs. J. W. Atkinson and T. O. Clark made the boards a proposal to construct the road for \$13,000.00, the State to pay \$9,000.00 of the amount and Eagle county to pay \$4,000.00 by paying \$1,000.00 each year thereafter until the full amount was satisfied. The county commissioners being desirous that this proposal be accepted, the board of construction awarded Messrs. Atkinson and Clark the work on the above terms and the boards of construction jointly with the board of county commissioners entered into a contract with them for the road complete, to be finished on or before the 8th day of February, 1906; but owing to the scarcity of labor, the contractors had to ask for an extension of time. They are to complete it by June 1st, 1907. They have the work about complete for 17 miles out from Basalt, leaving about 2 miles to build on the Ruedi end.

## FINANCIAL STATEMENT.

Appropriation, 1903 balance.....		\$3,750 .37
Appropriation, 1905.....		5,500 .00
Appropriation by county.....		4,000 .00
M. J. McKissock, stenographer.....	\$ 11.10	
A. K. Vickery, salary and expense, revising survey.....	54.50	
Publishing notice to contractors.....	6.41	
C. W. Wells, salary as deputy in charge of work.....	90.00	
C. W. Wells, expense as deputy in charge of work.....	70.35	
J. W. Atkinson and T. O. Clark, on contract.....	7,760.00	
Amount of contract not satisfied.....	5,240.00	
Balance in fund unpledged.....	18.01	
	\$13,250 .37	\$13,250 .37

## GRAND COUNTY ROAD.

Senate Bill No. 227 appropriated \$5,000.00 and House Bill No. 295 appropriated \$6,500.00 to be used to construct a wagon road from a point six miles, more or less, east of Hot Sulphur Springs, Grand county, by the most feasible and practicable



route along the course of Willow creek, to the summit of Willow Creek pass, the dividing line between Grand and Larimer counties, to intersect a road built by Larimer county from Walden to said Willow Creek pass.

The Governor, State Engineer and chairman of the board of county commissioners of Grand county (Hon. R. O. Throckmorton, for 1905, and Hon. Edmund Becker for 1906) were constituted the board of construction.

June 15th, 1905, the Governor and State Engineer went to Hot Sulphur Springs and held a formal meeting of the board of construction. On the 16th, in company with the Hon. R. O. Throckmorton, they made an inspection of the country from the Dexter postoffice on Willow creek to the local land mark known as Windy Gap to determine at what point it would be best to connect with the Denver, Northwestern and Pacific Railroad. Agreeable to the latitude given the board by the legislative act, in the matter of locating the road, "and varying the general course where it may be necessary in their opinion to carry out the general objects of this act," and the main object of the act being to provide the people of North Park with a railroad outlet, the board concluded that the proper route for the road, going south from the Dexter postoffice, was to take as direct a course from there to the railroad station of Granby as the contour and physical condition of the country would permit. This, however, would involve a right of way question across some valuable ranch property, which would not be encountered should the road go direct to Windy point. The Denver, Northwestern and Pacific Railroad people agreeing to take care of all questions of right of way, Granby was selected as the southern terminal of the road. On June 22nd, Mr. William Harris, an engineer located in Sulphur Springs, was employed at the request of the Hon. R. O. Throckmorton, to make the survey of that portion of the road extending from Willow pass down Willow creek to the Dexter postoffice, thence southerly towards Granby to an intersection with the county road from Sulphur Springs to Grand Lake, at some point near Bunte's ranch, on section 35, township 2 north, range 77 west of the 6th P. M., and arrangements were made with the railroad officials, whereby they were to make the location survey from the end of Mr. Harris' survey to the town of Granby, after they had secured the right of way for such line.

On June 27, 1905, a notice was inserted in both papers published in Sulphur Springs, and one Denver paper, asking that proposals be submitted for this work on or before the 1st day of August, 1905. On the 13th day of July returns were received from the engineers in charge of the surveys in the form of complete field notes. Mr. Harris' survey showed a distance of 24 miles from Willow Pass to Bunte's ranch fence. The notes furnished by the chief engineer of the Denver, Northwestern & Pacific Railroad, Mr. H. A. Sumner, showed a distance of 31½ miles from end of Harris' survey to the town of Granby.

On August 1, 1905, the board of construction met and were favored with the following proposals:

Fred A. Felch, Sulphur Springs, Colorado:	
From Station 0, Willow Creek Pass to Bunte's ranch line, Station 1238,	
Harris' survey.....	\$10,000 00
T. S. Farris, Sulphur Springs, Colorado:	
From Station 0, Willow Creek Pass to Bunte's ranch line, Station 1238,	
Harris' survey.....	8,705 64
Bridge across Grand river between Bunte's ranch line and town of	
Granby.....	1,401 00
Grade approaches to same, per cubic yard.....	.35
E. C. Phillips, Longmont, Colorado:	
From Station 0, Willow Creek Pass to the town of Granby, Harris' and	
Sumner's surveys.....	11,000 00

There appearing to have been a misunderstanding regarding the southern terminus of the road, Mr. Felch and Mr. Farris were asked to submit supplemental proposals for that portion of the road from the end of Harris' survey to the town of Granby. This Mr. Farris did not care to do. Mr. Felch made a proposal of \$3,000.00 for this portion. Mr. E. C. Phillips' bid being the lowest, he was awarded the work, and he entered into a contract with the board agreeing to complete the road on or before the 1st day of November, 1905. Owing to the severe weather, a characteristic of this locality, setting in early, his time was extended until August 1, 1906. The contractor, however, provided a temporary road and constructed all bridges on the line in order to permit the use of the road to the time fixed by the extension. On August 14, 1906, a final inspection was made, the work accepted and final settlement had with the contractor.

Shortly after work was begun, it developed that the road entered the Medicine Bow Forest Reserve about 2 miles northwest of Dexter Postoffice and continued within its boundaries to Willow Pass. After a long series of correspondence, the matter was finally adjusted and the government granted a permanent easement to the State of the necessary right of way; the same being a strip of ground 100 feet wide and 15 miles long.

## FINANCIAL STATEMENT.

Appropriated by Senate Bill No. 227.....		\$5,000 00
Appropriated by House Bill No. 295.....		6,500 00
C. W. Wells, salary as deputy in charge of work.....	\$ 108.00	
C. W. Wells, expense as deputy in charge of work.....	38.58	
Wm. Harris, surveying, on contract.....	340.00	
Publishing notice to contractors.....	13.42	
E. C. Phillips, on contract.....	11,000.00	
	\$11,500.00	\$11,500.00

## HINSDALE COUNTY ROAD.

Senate Bill No. 73 appropriated \$3,500.00 to be used to extend an uncompleted road up Hanson creek to the San Juan county line, along the most feasible route and connect with the Silverton-Ouray wagon roads. The road was to be constructed along the line of a survey already on the ground, from the end of a portion of the road previously built to a point locally known as Rose's Cabin, a distance of 6,350 lineal feet; from there to the top of the range the location was to be projected.

The State Engineer and the board of county commissioners of Hinsdale county (Hon. D. S. Hoffman, chairman, and Hons. E. J. Hall and S. F. Williams) were named by the act as a board of construction. Nothing was done with this road during the year 1905; but after fully considering the character of the country over which the road would have to be constructed, it was apparent to the board that the amount of money would not construct the entire road as contemplated by the act. So it concluded to advertise for that portion already surveyed, and after contracting it to then determine what would be best to do with whatever remained in the fund. Consequently, on June 11, 1906, a notice was inserted in one paper in Lake City, asking that bids be submitted on or before June 30, 1906. On that date there was received but one proposal for the work; it being that of Mr. Charles Schafer, who proposed to do the work as specified for the sum of \$2,600.00. This bid was not accompanied by a certified check and was very informal; besides, it appeared very high. As a consequence, it was rejected, the advertisement continued to July 7, 1906. On that date the following bids were received:

Chas. Schafer, Lake City, Colorado.....	\$2,600 00
Jas. Watson, Lake City, Colorado.....	2,350 00

The bids, appearing excessive, were rejected, and on July 20 notice was inserted in the papers asking that proposals be again

made, the time for receiving bids to end August 8, 1906. On that date the board of county commissioners of Hinsdale county met at Lake City as a board of construction and were favored with the following proposals, regular in form and accompanied by certified checks:

Chas. Schafer, Lake City, Colorado.....	\$2,600 00
Theodore Watson, Lake City, Colorado.....	2,400 00

These bids were forwarded to the State Engineer, and while they were still considered excessive, this was really the third advertisement for bids without any better results than was had the first. It was agreed to award the work to Mr. Theo. Watson, and a contract was entered into whereby the road to Rose's Cabin was to be completed on or before the 30th day of November, 1906. On October 25 notice was received that the contractor had completed his work. An inspection was made on November 1, the work accepted, and the contractor settled with in full.

The money that still remains in the fund was not enough to justify incurring the necessary expense to survey the road through to the top of the range, therefore there has been nothing further done.

#### FINANCIAL STATEMENT.

Appropriation.....		\$3,500 00
C. W. Wells, salary as deputy in charge of work.....	\$ 12 00	
Publishing notice to contractors.....	5 89	
Theo. Watson, on contract.....	2,400 00	
Balance in fund.....	1,082 11	
	\$3,500 00	\$3,500 00

#### OTERO COUNTY ROAD.

House Bill No. 364 appropriated \$4,000.00 to be used towards constructing and improving the wagon road between La Junta and Rocky Ford. The State Engineer and the board of county commissioners of Otero county (Hons. J. J. Brown, J. W. Fisher and G. W. Ingalls) were named as a board of construction. Of such board the State Engineer was named as chairman and the chairman of the board of county commissioners named as secretary.

Early in July, 1905, the board held a meeting in La Junta and it was arranged that the county of Otero would do what grading was required between La Junta and Rocky Ford, and the money appropriated by the State would be used to surface





Shale Surfacing Bent County Road, Near Las Animas.



Shale Surfaced Road, La Junta to Rocky Ford, Otero County.



the road. August 19th a notice was inserted in one paper at La Junta asking that bids be submitted on or before September 29, 1905, for the following kind and amount of work: Commencing at a point one-half mile west of the west line of the city of La Junta, thence extending along the county road towards Rocky Ford and along the portion of such county road prepared, by the county commissioners of Otero county, for receiving surfacing, and surfacing with shale from the nearby beds as much road, 15 feet in width to a depth of 8 inches in the center and a depth of 2 inches on the edges, as can be done for the sum of \$3,750.00; the contractor to be paid per the square yard of surface covered.

On September 4, 1905, the board of construction met and received the following proposals:

James S. King, La Junta, Colo., 50 cents per square yard of surface covered.

Messrs. Evans and Berry, La Junta, Colo.,  $18\frac{3}{4}$  cents per square yard of surface covered.

These bids, being considered excessive, were rejected, and the work was readvertised, asking that proposals be submitted on or before September 30, 1905. On the 4th day of October, 1905, the board of construction met and opened the following bids:

Messrs. Berry and Evans, La Junta, 12 cents per square yard.

Jas. S. King, La Junta, 54 cents per cubic yard, spread to conform to the requirements of the specifications.

The board calculated that King's bid would be at the rate of  $12\frac{1}{2}$  cents per lineal foot of road surfaced. The bid of King was considered the lowest, and the work was awarded to him to surface enough road to consume the \$3,750 available and complete the same on or before the 31st day of December, 1905, and a contract was entered into. Owing to unavoidable delays, the time was extended until February 1, 1906. On the 23rd of January, 1906, the work was inspected, measured and accepted, and final settlement made. There was still remaining in this fund, after all expenses and the contractor was paid in full, the sum of \$200.00. The board instructed the contractor to keep on at work at 54 cents per cubic yard of material spread, and widen some portions of the road, that, owing to their being on embankments, were considered narrow. On March 7 an inspection was made of the work done under the extra orders. The commissioners reported that Mr. King had delivered and spread 587 cubic yards, amounting to \$316.98, of which the board of construction paid \$209.52 and Otero county paid \$107.46. The total length of road surfaced was 30,000 lineal feet, a small portion being 20 feet wide, the balance 15 feet in width.

## FINANCIAL STATEMENT.

Appropriation.....		\$4,000.00
C. W. Wells, salary as deputy in charge of the work.....	\$ 24.00	
C. W. Wells, expense of deputy in charge of work.....	9.48	
Publishing notice to contractors.....	7.00	
James S. King, on contracts.....	3,959.52	
	\$4,000.00	\$4,000.00

## LA PLATA COUNTY ROAD.

Senate Bill No. 31 appropriated \$6,000.00 to be used to construct a wagon road from the terminus of the Junction Creek road near the city of Durango, La Plata county, Colorado, by the most feasible route, along or near Junction creek, to the junction of Flagler Fork and Junction creek in said La Plata county. The State Engineer and the board of county commissioners of La Plata county (Hon. S. H. Thompson, George Logan and Howard Charlton) were designated as a board of construction under whose supervision the road was to be viewed, located and constructed. On the 25th day of August, 1905, an inspection was made and the kind and amount of work to be done decided on, and Mr. W. H. Wigglesworth, county surveyor of La Plata county, was employed by the board to make a survey of the road. He commenced at the junction of Flagler Fork with Junction creek and layed out new road to be built to station No. 150, being 15,000 lineal feet, from that point to the end of the county road, six miles out from Durango. The work was that of improving, widening and bridging a road that had been previously temporarily constructed. The survey was completed and returns made by the 1st day of October. A notice was inserted in one paper at Durango asking that proposals be submitted on or before October 21 for six miles of wagon road, three miles to be entirely new and three miles the rebuilding of the old road. On October 23 the board of county commissioners of La Plata county met in Durango as a board of construction, and opened the following proposals, to wit:

D. W. Hoover, Durango, Colo., proposed to build the road by day labor at \$6.00 per day for self and cost of labor and material plus 10 per cent. This offer meant for him to furnish all tools necessary. W. A. O'Brien, Durango, Colo., to build the road as specified and to do all the work outlined between Flagler Fork and mile post 3 for \$5,700. The Hoover bid not being considered regular by the board of county commissioners, they recommended that Mr. O'Brien's bid be accepted, which was done, and he was awarded the work. He entered into a



contract agreeing to have the road completed on or before June 30, 1906. Mr. Wigglesworth was appointed inspector of the work. His salary for such work was to be paid by La Plata county. On July 21 notice was received that the contractor had completed the work, and on August 20 the State Engineer made a personal inspection, the work was accepted and final settlement made.

## FINANCIAL STATEMENT.

Appropriation.....		\$6,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 60.00	
C. W. Wells, expense as deputy in charge of work.....	49.05	
Wood & Morgan, livery.....	5.00	
W. H. Wigglesworth, making surveys.....	83.75	
Publishing notice to contractors.....	8.19	
Geo. C. Logan, expense trip of inspection.....	23.00	
W. A. O'Brien, on contract.....	5,700.00	
Balance in fund.....	71.01	
	\$6,000.00	\$6,000.00

## LARIMER AND BOULDER COUNTIES ROAD.

House Bill No. 200 appropriated \$10,000.00, to be used for the purpose of constructing a wagon road over the most practicable route, from a point commencing at or near the "Handy Dam" in Big Thompson canon, in Larimer county; thence following the course of the Big Thompson river through said Big Thompson canon to and into Estes park, in Larimer county; thence continuing up Fish creek past the "Long's Peak House," and continuing on, crossing the county line between Larimer and Boulder counties, near the corners of sections 34 and 35, T. 4 N., R. 73 W., and sections 2 and 3, T. 3 N., R. 73 W., to and intersecting the county road in "Allen's Park."

The Governor, State Engineer, chairman of the board of county commissioners of Larimer county (Hon. I. W. Bennet, 1905, and Charles Gilpin Brown, 1906), and chairman of the board of county commissioners of Boulder county (Hon. Nicholas R. Herival), were named as a board to have charge of all matters connected with such road construction. An inspection was made of the route, beginning at "Handy Dam," the eastern terminus, and going as far as the top of Lillie Hill on the south side of Estes Park, a road 8 feet wide was found, and that portion that was not hemmed in by box canons was much wider, and as a general thing in good shape. It was the opinion of the board that the canon work should be widened to ten feet, with plenty of turn-outs, and in places where the road was high enough above the

river to make it dangerous, it should be widened to 15 feet. Mr. A. K. Vickery was employed to make a survey of the entire route as covered by the act. He was instructed to adhere to the road as he found it from Handy Dam to Estes Park, taking note of such work as would be needed to improve it as above outlined; from Estes Park to the bottom of Lillie Hill the road was to be accepted by him as needing no work at the hands of the State. A new road was to be located at Lillie Hill, using an 8 per cent. maximum grade; from there he was to go into Boulder county and make a survey on any part of the road requiring betterment. On July 8, 1905, the survey was completed, and on July 14, 1905, the board inspected it and decided to advertise for bids at once, the portion in Boulder county and down Lillie Hill to be done for a fixed sum for the work, the portion from "Handy Dam" to Estes Park to be done by the cubic yard; the work to be cross-sectioned and staked; work to begin at Handy Dam and continue along the road as outlined in the survey notes as far as possible for the sum of \$7,500.00. A notice was inserted in one Fort Collins paper and in one Boulder paper, asking that bids be submitted for the work as surveyed on or before September 2, 1905. On that date the board of construction met and was favored with the following proposals:

W. A. Riley, Loveland, Colorado, from Handy Dam to Estes Park:		
Class A (Earth).....	\$0.60 per cubic yard.	
Class B (Loose rock).....	.90 per cubic yard.	
Class C (Solid rock).....	2.00 per cubic yard.	
Surfacing.....	.75 per square yard.	
Retaining walls.....	2.50 per square yard.	
Bridging.....	5.00 per lineal foot.	
Culverts, 1x1 foot.....	5.00 per lineal foot.	
Culverts, 2x2 feet.....	5.50 per lineal foot.	
Culverts, 3x3 feet.....	6.00 per lineal foot.	
Martin Keough and Henry Steward, Salina, Colorado:		
Lillie Hill, station 0 to station 76.....	\$3,040.00	
First section, Boulder Co., station 0 to station 17.....	680.00	
Second section, Boulder Co., station 0 to station 10.....	400.00	
Total.....		\$4,120.00

Knowlton & Bollen Construction Company, Fort Collins, Colorado, from Handy Dam to Estes Park:	
Class A (Earth).....	\$0.30 per cubic yard.
Class B (Loose rock).....	.60 per cubic yard.
Class C (Solid rock).....	1.30 per cubic yard.
Surfacing.....	.20 per square yard.
Retaining wall.....	2.00 per square yard.
Bridging.....	40.00 per M in place.
Culverts, 1x1 foot.....	.60 per lineal foot.
Culverts, 2x2 feet.....	1.00 per lineal foot.
Culverts, 3x3 feet.....	1.50 per lineal foot.

For all work not covered by proposal, cost of work plus 15 per cent. to cover use of tools.

Hendry Johnson, Boulder, Colorado, from Handy Dam to Estes Park:	
Class A (Earth).....	\$0.25 per cubic yard.
Class B (Loose rock).....	.40 per cubic yard.
Class C (Solid rock).....	1.75 per cubic yard.
Retaining wall.....	2.00 per square yard.
Bridging.....	1.50 per lineal foot.
Culverts, 1x1 foot.....	.30 per lineal foot.
Culverts, 2x2 feet.....	.50 per lineal foot.
Culverts, 3x3 feet.....	.70 per lineal foot.
Lillie Hill, station 0 to station 76.....	\$2,300.00
St. Vrain Hill, station 0 to station 17.....	600.00
Fox Creek, station 0 to station 10.....	300.00

The bid of Knowlton and Bollen Construction Company was considered the lowest on that portion of the work from Handy Dam to Estes Park and the work was awarded it.

Sanford D. Buster, Allen Park, Colorado, all that part of the road situate in Boulder county, consisting of the hills as surveyed at St. Vrain river and Fox creek, as well as clearing road of boulders from county line to St. Vrain hill, station 0 to 17, station 0 to 10, Fox creek, for \$950.00.

The bid of Mr. Buster being considered reasonable, it was accepted. The season of the year making it impossible to do any work on the portion known as Lillie hill, the board thought it best to reject all bids for it, and take the matter up in the spring of 1906.

Sanford D. Buster entered into a contract, agreeing to complete the work on or before the 30th day of December, 1905. Owing to bad and severe weather setting in earlier than usual, he

asked that his time be extended until June 1, 1906, a request which was granted by the board.

The Knowlton and Bollen Construction Company entered into a contract for the work between Handy Dam and Estes Park, agreeing to consume the \$7,500.00 on or before the 30th day of January, 1906. This time was extended to May 1, 1906. On April 23, 1906, the State Engineer made a personal inspection of all work done by the Knowlton and Bollen Construction Company and the work was accepted. The total work done by it amounted to \$7,078.10. Settlement was made in full on the 26th day of April, 1906.

The snow having disappeared from Lillie hill, May 11, 1906, a notice was inserted in one paper at Boulder and one paper at Fort Collins, asking that proposals be submitted on or before the 2nd day of June, 1906, for a road 10 feet in width, 7,600 feet in length, down Lillie hill. On that date, the board of construction met and received one bid. Mr. Norton H. Billings, of Lyons, Colorado, proposed to do the work for \$950.00. His bid was considered reasonable and was accepted. He entered into a contract agreeing to complete the work on or before the 10th day of July, 1906. Owing to a long siege of rainy weather, it was necessary to extend his time to August 1, 1906.

On October 10, 1906, the road built by Sanford D. Buster and that built by Norton H. Billings were thoroughly inspected by the State Engineer and Hon. Nicholas R. Herival, and were accepted and settlement in full made.



## FINANCIAL STATEMENT.

Appropriation.....		\$10,000.00
C. W. Wells, deputy in charge of work.....	\$ 186.00	
C. W. Wells, expense, deputy in charge of work.....	172.29	
A. K. Vickery, charge of surveys.....	144.00	
A. K. Vickery, expense of surveys.....	88.10	
Harrison Kronslop, assistant on surveys.....	16.00	
J. D. Ricker, assistant on survey.....	30.00	
Clark Neff, assistant on survey.....	22.50	
E. G. Van Breamer, boarding survey party.....	20.00	
Johnson Bros. livery team on survey.....	89.50	
M. J. McKissock, stenographer.....	3.70	
T. W. Jaycox, expense trip of inspection.....	6.50	
Advertising notice to contractors.....	16.16	
Kendrick Book and Stationery Co., level rod.....	3.25	
Lallie Surveying Instrument Co.....	2.50	
J. W. Danner, survey stakes.....	11.60	
Sanford D. Buster, on contract.....	950.00	
Norton H. Billings, on contract.....	950.00	
The Knowlton & Bollen Con. Co., on contract.....	7,078.10	
Balance in fund.....	209.80	
	\$10,000.00	\$10,000.00

## MESA COUNTY ROAD.

Senate Bill No. 113 appropriated \$2,500.00 to be used in completing certain work on the wagon road between the town of De Beque and the crossing of Plateau creek, about two miles west of the town of Collbran. An appropriation of \$3,000.00 had been made by the Fourteenth General Assembly, and all that was required to make a good road had been done from De Beque for a distance of about 10 miles out, leaving about 10 miles over which this appropriation was to be extended. The State Engineer, the chairman of the board of county commissioners of Mesa county (Hon. Jas. H. Smith) and the county surveyor of Mesa county (Frank Schwalbach) were named as a board of construction.

On May 6th and 7th, 1905, the board made a trip of inspection over the proposed road and instead of following the old road from the top of the divide between Grand river and Plateau creek to Plateau creek, a new line was selected, going down what is locally known as Anderson gulch, meeting Plateau creek about one mile below the crossing which was to be the south terminus of the road, thence to follow the creek on the north

bank to the bridge, the total length of the new line being 14,636 lineal feet. Two other points were selected as needing improving by building a new road; on these the survey as previously made was adopted, being at station 445 to station 452+50 and station 462 to station 472 of the original survey. It was decided, however, to ask for proposals for the portion down Anderson gulch, thence up Plateau creek to the bridge; and contract that before the other sections were to be considered. On May 16th, 1905, a notice was inserted in one paper at Collbran, one at De Beque and one at Grand Junction, asking that bids be submitted for the Anderson gulch and Plateau creek sections, on or before the 3rd day of June. On the 7th day of June, 1905, the board met and opened the following proposals:

O. C. Pitts, Collbran, Colorado.....	\$1,900 00
C. C. Hopple, De Beque, Colorado.....	2,100 00
S. J. Kiggins, Grand Junction, Colorado.....	2,150 00

Mr. Pitt's bid being the lowest, the work was awarded to him. He entered into a contract for the work, agreeing to complete it on or before the 1st day of October, 1905. During the summer the high water of Plateau creek demonstrated the advisability of making a slight change in the road as located. After conferring with the contractor, it was decided to have the change made and to allow him \$100.00 for the extra and additional work required.

On the first day of October, 1905, notice was received that the work was completed and on October 8th, 1905, the board inspected and accepted the work and final settlement was made. Nothing was done further, however, on this road until April 18th, 1906, when a notice was inserted in one paper in Collbran and one paper in De Beque, asking that proposals be submitted for the other two sections on or before May 1st, 1906. There was but one bid received for the work; it being that of O. C. Pitts, of Collbran, who proposed to construct the road from station 445 to station 452+50 and from station 462 to 472, making a total of 1,850 lineal feet, 10 feet wide, with turnouts, for \$475.00. At this time there remained \$386.62 in the fund and it was impossible to accept Mr. Pitts' proposition unless the county commissioners would care for the excess. This they finally agreed to do, and the board entered into a contract with Mr. Pitts whereby he was to complete the work on or before the 30th day of November, 1906. On that date the local members of the board reported that the work had been completed. It was accepted and settlement made by the State paying \$386.62 and the county of Mesa paying \$88.38.

## FINANCIAL STATEMENT.

Appropriated by state. ....		\$2,500 00
Appropriated by Mesa county.....		88 38
C. W. Wells, salary as deputy in charge of work. ....	\$ 72 00	
C. W. Wells, expense as deputy in charge of work.....	34 95	
Publishing notice to contractors.....	6 43	
O. C. Pitts, on contracts.....	2,475 00	
	\$2,588 38	\$2,588 38

## MONTROSE COUNTY ROAD AND BRIDGES.

House Bill No. 288 appropriated \$2,000.00 to be used to construct a road in the southwest part of Montrose county.

The State Engineer, the board of county commissioners of Montrose county (Hons. O. H. Horton, Ira H. Monell and Philo L. Hutchins), were designated as a board of construction; the State Engineer to select the route and survey the road to conform as near as practical to the route as above outlined.

The surveys were made by Mr. W. E. Hance, a local engineer in Montrose county, at the expense of the county commissioners, to determine where the money should be spent. The surveys were completed October 24, 1905, and it was decided by the board to use the appropriation in doing the following pieces of work, to be considered in the order herein given, dropping the last in case there was not money enough in the State fund to complete all. A bridge at the crossing of San Miguel river, a road on a grade not to exceed 10 per cent., 10 feet road bed down Tabeguache Hill from Tabeguache Park to Tabeguache creek, a bridge across said creek.

The bridge across San Miguel river to be a 64-feet span Pony truss, wooden bridge, 12 feet roadway in the clear, to be constructed of native yellow pine, supported by wooden crib abutments filled with rock.

The bridge across Tabeguache creek to be 30 feet long between abutments, flat decked 5 stringer bridge, supported by log abutments at either end; supported in the center by a framed bent or pier; bridge to be floored with 4-inch plank; all to be native materials.

Plans and specifications were prepared for the bridges and road, and on June 29, 1906, a notice was inserted in one Montrose newspaper asking that proposals be submitted on or before July 31, 1906. On that date two bids were received for the bridge to be constructed across the San Miguel river, as follows:

Messrs. Bowen and Brooks, Montrose, Colorado.....	\$990 00
Mr. A. S. Delaplane, Nucla, Colorado.....	728 00

Mr. Delaplane's bid being the lowest, the work was awarded him. A contract was entered into by him, whereby he was to complete the same by January 1, 1907. No bids were received for the road and the bridge across Tabeguache creek. On the 11th day of September, 1906, a notice was inserted in a paper in Montrose asking that proposals be submitted for the road down Tabeguache Hill and a bridge across Tabeguache creek, on or before September 24, 1906. On that date one bid was received, that of George T. Specht, Naturita, Colorado.

Road down Tabeguache Hill, 11,700 lineal feet .....	\$1,150.00	
Bridge across Tabeguache Creek.....	120.00	
Total of bid.....		\$1,270 00

The county commissioners agreeing to take care of all expense that might be required for inspection, etc., the bid of Mr. Specht was accepted, and a contract was entered into wherein he agreed to complete the work on or before the 30th day of December, 1906. Owing to cold weather setting earlier than anticipated, he was granted an extension of time until June 1, 1907. Mr. Delaplane has completed the bridge across the San Miguel river, but up to the present time it has not been inspected, consequently has not been accepted.

## FINANCIAL STATEMENT.

Appropriated by state.....		\$2,000 00
Appropriated by Montrose county.....		50 00
C. W. Wells, salary as deputy in charge of work.....	\$ 24.00	
C. W. Wells, expense as deputy in charge of work .....	.78	
Advertising notice to contractors.....	5.48	
A. S. Delaplane, pledged on contract.....	728.00	
George T. Specht, pledged on contract.....	1,270.00	
Balance in fund.....	21.74	
	\$2,050.00	\$2,050.00

## PITKIN COUNTY ROAD.

House Bill No. 285 of the Fourteenth General Assembly appropriated \$5,000.00 to be used to construct a State wagon road



in Pitkin county, from a point above the city of Aspen, near the mouth of the South Fork of Roaring Forks river, and running southeast into and through Lincoln Gulch.

The State Engineer and the board of county commissioners of Pitkin county were designated as a board under whose supervision the road was to be constructed.

At the beginning of this administration I found that a survey had been made of this proposed road. There was still available of this appropriation \$4,000.54 that could be used for the construction.

House Bill No. 190 appropriated an additional \$3,000.00 to be used for this road, making a total fund of \$7,000.54. The State Engineer, chairman of the board of county commissioners and the mayor of the city of Aspen (Hon. W. H. Twining) were designated as a board of construction, to superintend the handling and expending the money appropriated.

The board of county commissioners for the years 1905-1906 were Hon. Henry Beck, chairman, John Harkins and John S. Stewart. This gave two separate appropriations to be expended by different boards of construction. The matter was adjusted by the board of county commissioners delegating the chairman to act for them, which practically reduced the bodies to one board.

On July 25, 1905, a notice was inserted in one paper in Aspen asking that proposals be made on or before September 2, 1905. Bids were asked for by yardage, earth, loose rock and solid rock classification, also by the lump sum between the initial points, the total length of the road to be built being 56,594 lineal feet. The following proposals were submitted:

The Crescent Grading and Construction Co. by A. F. Meyers, Florence, Colorado	\$6,800.00
T. O. Clark and J. W. Atkinson, Aspen, Colorado.....	10,500.00
Clark and Atkinson also proposed to build the road if allowed to change survey on the 3 miles nearest Aspen, for.....	9,000.00

On the 25th day of September the board met and opened the above bids. That of The Crescent Grading and Construction Company being much the lowest, it was accepted and a contract was entered into whereby the contracting company agreed to complete the road on or before the 1st day of September, 1906. Early winter setting in, it was not possible for the contractor to do anything during the year 1905, the road being situate at above 10,000 feet. Scarcity of labor and winter setting in early prevented the contractor from getting more than half through. His time has been extended until August 1, 1907.

## FINANCIAL STATEMENT.

Balance in appropriation, 1903.....		\$4,000.45
Appropriation, 1905.....		3,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 48.00	
C. W. Wells, expense as deputy in charge of work.....	38.05	
Lee McMullen, re-establishing survey.....	54.00	
Publishing notice to contractors.....	6.51	
A. F. Meyers, paid on contract.....	2,800.00	
A. F. Meyers, pledged on contract.....	4,000.00	
Balance in fund.....	53.98	
	\$7,000.54	\$7,000.54

## SUMMIT COUNTY ROAD.

Senate Bill No. 29 of the Fourteenth General Assembly appropriated \$1,000.00 to be used to construct a wagon road from Breckenridge to Boreas Pass, to be located as near as may be along and upon the old toll road from Breckenridge to Hamilton, Park county.

The Governor, State Engineer and chairman of the board of county commissioners were named as a commission to construct the road.

House Bill No. 89 of the Fifteenth General Assembly appropriated \$3,000.00 to be used to construct a road over the same route.

This act named the Governor, State Engineer and chairman of the board of county commissioners of Summit county (Hon. W. H. Hampton) as a commission to have charge of the construction. The plans and specifications for the road were to be prepared by the State Engineer.

At the beginning of my term of office, I found that a reconnaissance of the road had been made, a report of which was on file. There was still remaining in the fund \$903.00; this, with the later appropriation of \$3,000.00, gave 3,903.00 available money to be used on the project. From the report previously made, it was apparent that the entire road could be reconstructed with this amount. Owing to many other urgent matters taking up the State Engineer's time, it was not found possible to take this work up until the summer of 1906. On the 21st day of June the Governor and State Engineer went to Breckenridge, and, in company with the board of county commissioners, an inspection was made of the road to be bettered, and it was decided to rebuild about two miles of the Boreas Pass end, using a maximum grade of 10 per cent., roadbed to be 10 feet in width; also to rebuild one-fourth mile near Breckenridge on 8 per cent. grade, roadbed to be 10 feet; the balance of the road to be repaired generally. The



Rocky Point on Big Thompson River Road, Larimer County.



Beauty Spot on Road between Cripple Creek and Eldred Postoffice.





length of the road from Boreas Pass to Breckenridge proved to be 36,200 lineal feet.

Mr. James D. Galloway, of Breckenridge, was employed to make the surveys at \$15.00 per mile. On August 6th he furnished the State Engineer with complete notes. Specifications and profile was prepared and on August 14, 1906, a notice was inserted in one paper in Summit county, asking that proposals be submitted on or before September 10, 1906. At that time the board of construction met and were favored with the following bids:

Benjamin S. Williams, Breckenridge, Colorado.....	\$7,000.00
Frederick E. Jacot, Breckenridge, Colorado.....	3,750.00

Mr. Jacot's proposal being the lowest, the work was awarded to him, and he entered into a contract, agreeing to complete the work on or before the 30th day of November, 1906. On November 8th notice was received that the work was completed; it was inspected and accepted, and settlement in full was made.

## FINANCIAL STATEMENT.

Balance in 1903 appropriation.....		\$ 903.00
Appropriation, 1905.....		3,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 12.00	
J. D. Galloway, making surveys.....	102.75	
W. H. Hampton, expense, trips of inspection.....	22.80	
Advertising notice to contractors.....	2.66	
Frederick E. Jacot, on contract.....	3,750.00	
Balance in fund.....	12.79	
	\$3,903.00	\$3,903.00

## TELLER AND FREMONT COUNTIES ROAD.

Senate Bill No. 76 appropriated \$10,000.00 to be used in constructing a public wagon road from the city of Cripple Creek, Teller county, along Cripple creek to its confluence with Four Mile creek, thence along Four Mile creek to Eldred postoffice, in Fremont county. The State Engineer, chairman of the board of county commissioners of Teller county (Hon. C. S. Davisson), and the county surveyor of Teller county (George H. Atherton), were named as a board under whose supervision the road was to be located and constructed.

The act provided that the work of surveying the road should be done by the county surveyor of Teller county, working under instructions of the State Engineer. Early in June, 1905, the

board made a reconnoissance of the proposed route, and found that there were no obstacles to prevent getting a road from the city of Cripple Creek to the confluence of Cripple creek and Four Mile creek, the same being true of the route down Four Mile creek for a distance of one and one-half miles. At this point Four Mile creek enters a box canon, through which it continues for about four miles, and the Canon City and Cripple Creek Toll Road Company had constructed its road through this canon during the years 1892-1893, and have continued to use the canon as a roadway ever since.

It was the opinion of the board that it had better make surveys from Cripple Creek to an intersection with the toll road, and if it was found that the appropriation was large enough to construct that portion, the counties of Teller and Fremont would be asked to secure the portion of the toll road through the box canon of Four Mile creek and make it a public road.

Mr. Atherton was instructed to make the survey of such portion; he completed the same September 10th, showing that there would need to be 8.77 miles of road constructed to connect Cripple Creek with the toll road; in the judgment of the board of construction, this portion could be built for the money available.

On September 10th a notice was inserted in a Cripple Creek paper and one in a Victor paper, asking that proposals be submitted on or before October 21, 1905. On that date the board of construction met and were favored with the following proposals:

W. W. Kirk and C. H. McKee, Cripple Creek, Colo. . . . .	\$14,975 00
W. E. Pruett, Victor, Colo. . . . .	18,000 00
John Connor, Victor, Colo. . . . .	9,500 00
E. C. Phillips, Longmont, Colo. . . . .	9,500 00
Henry Bunte, A. F. Dawson and Chas. H. Berry, Cripple Creek, Colo. . . . .	9,250 00
Foley Brothers (John and Phil) Victor, Colo. . . . .	8,890 00

The Foley Brothers' proposal was the lowest and they were awarded the work, but could not enter into a contract until suitable arrangements had been made by the county commissioners regarding the taking over from the Toll Road Company the lower end of five miles of its road. On December 14, 1905, the two counties purchased the following portion of the toll road from the company. Beginning at a point on the east side of Four Mile creek, where the toll road crosses the creek (this is where the State road survey connects with the toll road), to Eldred post-office, for the sum of \$4,000.00, each county paying \$2,000.00. Proper notice having been given the State Engineer of the transaction, the board entered into a contract with the Foley Brothers, by the terms of which they were to complete the road on or before the 15th day of May, 1906. At that time the contractor gave no-

tice that the work was completed. It was inspected by the board of construction, as well as by the board of county commissioners of Teller county, and accepted; at the same time there was some extra and additional work ordered, for which a supplemental contract was entered into. On June 13th this extra work was inspected, accepted, and settlement made.

## FINANCIAL STATEMENT.

Appropriation.....		\$10,000.00
C. W. Wells, salary as deputy in charge of work.....	\$ 138.00	
C. W. Wells, expense as above.....	164.55	
Geo. H. Atherton on survey.....	269.06	
Claud Stotte, helping on survey.....	60.00	
W. J. Elliott, livery for survey.....	26.00	
Publishing notice to contractors.....	7.83	
Foley Bros., on contracts.....	9,205.83	
Balance in fund.....	182.73	
	\$10,000.00	\$10,000.00

## YUMA COUNTY ROAD.

House Bill No. 259 appropriated \$3,000.00 to be used to construct a wagon road through the bluff and hills on either side of the Middle Fork of the Republican river, better known as the Arickaree river, and across the wide, sandy bottoms on either side, and for the construction of a bridge across said river at the proper place, connecting the wagon road to be constructed upon the following described route, to wit: "Commencing at the southwest corner of section 28, T. 2 S., R. 44 W., of the 6th P. M.; thence to a point on the section line between sections 33 and 34, in T. 3 S., R. 44 W., of the 6th P. M., or upon the shortest and most feasible route, considering grades to be made, connecting the two divides on either side of said Arickaree river with the main road from Idalia to Vernon.

The State Engineer and the chairman of the board of county commissioners of Yuma county (Hon. J. A. Conley) to constitute a board under whose supervision the road was to be constructed. On the 10th day of August, 1905, Mr. C. W. Wells, a deputy of this office, made a reconnoissance of the route and the necessary surveys, and obtained a line having a maximum grade of 7 per cent., and but very little that steep, while the road would cross the river on a fairly good bridge previously built by the State and permit the money being spent on grading work. It was decided to build the road along the line as surveyed, and specifications and profiles were prepared for a 10-foot road bed. On May 21, 1906, a notice was inserted in one paper at Wray,

Yuma county, asking that proposals be submitted on or before the 18th day of June, 1906. On that date the board of construction met and were favored with the following bids, to wit:

Lincoln R. Scott, Idalia, Colo., 15 per cent. of cost added for extra work . . . .	\$2,693.00
Craig & Hinkel, Denver, Colo., 15 per cent. of cost added for extra work . . . .	2,500.00

Craig & Hinkel's proposal being the lowest, the work was awarded them, and they entered into a contract agreeing to complete the road on or before the 1st day of October, 1906. Later the contractor was ordered to do some additional work, which amounted to \$300.00. On the 5th day of August notice was received from the contractors that they had completed all the work: it was inspected by the board and accepted, and final settlement made on August 13.

#### FINANCIAL STATEMENT.

Appropriation.....		\$3,000.00
C. W. Wells, as deputy in charge of work and surveys.....	\$ 72.00	
C. W. Wells, expense in charge of work and surveys.....	99.65	
Publishing notice to contractors.....	2.85	
Craig & Hinkel on contract and extra.....	2,800.00	
Balance in fund.....	25.50	
	\$3,000.00	\$3,000.00

#### LAS ANIMAS COUNTY ARTESIAN WELL.

Senate Bill No. 330 of the Fourteenth General Assembly appropriated \$5,000.00 for the sinking of an artesian well somewhere in Sunflower basin, near a railroad station by the name of Hoehne, Las Animas county. The Governor, State Engineer and the chairman of the board of county commissioners of Las Animas county were designated as a board, whose duty it would be to definitely locate and sink the well.

On taking charge of this office I found that nothing had been done of a definite nature towards this well by my predecessor, although the board, as it was constituted, had held several meetings and had made at least two trips of inspection on the ground. I also found that there was still available for this purpose \$4,766.24.

For the years 1905 and 1906, Hon. J. S. Grisham was chairman of the board of county commissioners of Las Animas county. Early in May, 1906, the board selected a site for the well on the northeast corner of Mr. Joshua Coulson's property, providing he would donate one acre of ground, which he con-



sented to do, and later furnished a warranty deed, in fee simple, to the State, for one square acre in the northeast corner of the S. E.  $\frac{1}{4}$  of the S. E.  $\frac{1}{4}$  of section 7, T. 32 S., R. 69 W., of the 6th P. M. This tract is situate three-quarters of a mile southeast of the station Hoehne on the Atchison, Topeka & Santa Fe Railroad, and is on the south side of the Las Animas river. On June 12, 1906, a notice was inserted in one Trinidad paper and one Denver paper, asking that proposals be submitted on or before June 30, 1906, bids to be to sink a given number of feet, and case if considered necessary, for the sum of \$4,500.00, and a given price per foot for any additional depth. On that date the board met and was favored with but one bid, it being that of Messrs. Albert Brown of Florence and Charles Younglove of Boulder, under the firm name of Brown & Younglove, who proposed to sink 818 feet in depth for \$4,499.00, and \$5.50 for each foot thereafter in depth. This bid being considered reasonable, was accepted; a contract was entered into, by the terms of which the well was to be completed on or before the 30th day of November, 1906. On the 15th day of November the well was visited. It was found to be 849 feet deep, being  $8\frac{1}{4}$  inches in diameter at the bottom; for the first 80 feet in depth it had been drilled with a 12-inch bit and was cased with 10-inch casing; below this to the bottom it was not cased.

At a depth of 35 feet solid formation was encountered, which is Pierre shale, and it continues in this shale to the bottom. No water was encountered after the first 35 feet were passed. At a depth of 700 feet a considerable flow of natural gas was encountered. At the bottom there were strong indications of oil. The material passed through is as follows:

1-35 feet earth, gravel, water.....	35 ft.
2-814 feet Pierre shale.....	849 ft.

From the indications, as exhibited at the well, and from results obtained by drilling other wells in the immediate vicinity, I consider this project worthy of having additional money expended by the State on it, and would recommend that there be further aid given to be used towards prospecting the underlying strata of this locality to a depth of 3,000 feet.

## FINANCIAL STATEMENT.

Amount of appropriation available.....		\$4,766 24
C. W. Wells, salary as deputy in charge of work.....	\$ 18.00	
Publishing notice to contractors.....	4 16	
Brown and Younglove, on contract.....	4,669 50	
Balance in fund.....	74 58	
	\$4,766 24	\$4,766 24

## DOLORES COUNTY ROAD.

House Bill No. 27 of the Fourteenth General Assembly appropriated \$5,000.00 to be used in constructing a wagon road from Coke Ovens, a station on the Rio Grande Southern Railroad, running thence in a westerly direction to Dunton postoffice.

The Governor, State Engineer and the chairman of the board of county commissioners of Dolores county (Hon. Victor H. Lee) constituting the board of construction.

When I took charge of the State Engineer's office I found that this work had been contracted for with Mr. A. F. Myers, of Florence, Colorado, for the sum of \$4,200.00, and that he had completed perhaps one-half of the work, and had been paid \$1,500.00 as a partial payment; that the time for completing said work had been extended from October 1st, 1904, to June 1st, 1905. On June 9, 1905, his time was again extended until October 1st, 1905. On the 11th day of October, 1905, an inspection was made of the work and it was found that there was about 80% of it done, and considering that winter had at that time already set in, the contractor's time was again extended until the fall of 1906; but he has not completed it as contracted, and I would recommend that in the spring of 1907 he be required to take hold of it and pursue it to completion; in the event of his not doing so, that his contract be declared forfeited, and the remainder of the money be used toward finishing the road in accordance with the provisions of the terms of the contract.

On December 7th, 1905, the contractor was made a partial payment on his contract of \$1,700.00, making a total payment to date of \$3,200.00.

## FINANCIAL STATEMENT.

Amount of appropriation available.....		\$2,814.12
C. W. Wells, salary as deputy in charge of work.....	\$ 36.00	
C. W. Wells, expense as above.....	32.05	
A. F. Meyers, on contract.....	1,700.00	
A. F. Meyers, pledged on contract.....	1,000.00	
Balance in fund.....	46.07	
	\$2,814.12	\$2,814.12

## CHAFFEE, LAKE AND EAGLE COUNTIES ROAD.

Senate Bill No. 347 of the Fourteenth General Assembly appropriated \$3,000.00 to be used to construct and improve a State road from the town of Buena Vista, Chaffee county, to the town of Red Cliff, Eagle county, via the city of Leadville, thereby traversing Lake county. On taking charge of this office I found

that there was still unexpended of this fund \$1,438.05, and that it was available. Unintentionally this matter was overlooked until the season was so late that it was considered out of reason to try to do anything on the road. The project is, however, a worthy one, and I would recommend that the fund remain intact and that it be taken up next year. I might add in connection with this case that suitable arrangements be had with the Denver and Rio Grande Railroad, whereby the State can secure control of the old narrow gauge road bed which has been abandoned for railroad purposes over Tennessee pass, going from Leadville down into Eagle park on the western slope. This would make an excellent road; a considerable portion is now being used for that purpose, but the State would not be justified in spending any money improving and bettering it unless an easement was granted.

#### DOUGLAS COUNTY ROAD.

House Bill No. 403 of the Fourteenth General Assembly appropriated \$3,000.00 to be used to construct a wagon road from the town of West Creek to a point on the west line of Douglas county, near the Cheesman dam. A survey and report had been made by my predecessor of the project. There is still remaining in this fund \$1,901.05, and I would recommend that such action be taken that would transfer this sum from the road as designated to some main connecting road in Douglas county.

#### GUNNISON COUNTY ROAD.

House Bill No. 97 of the Fourteenth General Assembly appropriated \$4,000.00 to be used to construct a wagon road from near the town of Irwin, down Anthracite creek to the confluence of Coal creek, to be constructed under the directions and supervision of a board to be composed of the State Engineer and chairman of the board of county commissioners of Gunnison county (Hon. J. M. Custer). At the time I became State Engineer I found that a location survey had been made by my predecessor, that the work had been advertised and bids submitted, which were all far in excess of the amount of money available. There was still in the fund \$3,074.11. During the past two years I have not had a call from the chairman of the board of county commissioners asking that an attempt be made to construct the road, although on the 7th day of July, 1906, a letter was sent to the chairman of the board, asking that an expression be given of his wishes as a member of the board concerning the expenditure of this money. Feeling that the project is one of no special merit, I would recommend that the amount remaining in the fund be turned back and that the project be abandoned.

#### LITTLETON-PALMER LAKE CYCLE PATH.

Senate Bill No. 408 of the Twelfth General Assembly appropriated \$5,000.00 to be used for the purpose of constructing



a State cycle path from the town of Littleton, Arapahoe county, to the town of Palmer Lake, El Paso county. The State Engineer and three persons to be appointed by the Governor were to constitute the board of construction. During the years 1899 and 1900 surveys were made in connection with the project. There is still remaining in the fund \$4,455.25. I would recommend that the act be amended so that this money might be expended on the main traveled public wagon road between the designated initial points.

#### LA PLATA COUNTY WAGON ROAD.

House Bill No. 92 of the Fourteenth General Assembly appropriated \$5,000.00 to be used in the construction of a wagon road from the city of Durango to the Neglected Mine, La Plata county. The Governor, the State Engineer and the chairman of the board of county commissioners of La Plata county were designated as a board of construction, the Governor being named as chairman and the State Engineer as secretary of the board.

When I became State Engineer I found that this road had been let to Messrs. D. W. Hoover and Frank N. Hoover, for the sum of \$6,500.00; the excess to the amount of \$2,700.00 having been provided by public subscription and deposited in the First National Bank of Durango. The date for completing the road called for in the contract was July 1st, 1905. This time afterwards extended to August 15th, 1905. Mr. Blair Burwell had been appointed inspector, he previously having made the survey over which the road was being built. There was still in the fund appropriated \$3,712.95 and \$1,457.00 in the funds furnished by subscription. On August 14th, 1905, Mr. Burwell notified this office that the work was completed, and on the 25th day of August, the work was inspected and in a general way found to comply with the specifications. There still being, however, some small sections which the board considered should be bettered before final settlement would be made, it was agreed that \$300.00 of the money on deposit in the bank should be held back until such matters as were designated in a letter of August 30, 1905, to D. W. Hoover, had been attended to and completed. At this time the contractors were paid \$3,635.00 from the State fund, and \$1,157.00 from the subscription fund.

#### FINANCIAL STATEMENT.

Balance appropriated by state.....		\$3,712.95
Balance appropriated by subscription.....		1,457.00
Blair Burwell, as inspector.....	\$ 75.00	
D. W. Hoover, on contract.....	4,792.00	
Balance in fund.....	302.95	
	\$5,169.95	\$5,169.95





Flume on Dolores River, Showing Difficult Construction.



Section of Clear Creek County \* Wagon Road, from Alice to Dumont.



## GOOD ROADS.

Public sentiment in favor of better roads has grown so rapidly within the past decade, that I feel safe in saying, that we have under consideration, one of the most important topics now being weighed by the people of this great State, a subject which is commanding the attention, agitating the minds, and demanding the best thoughts and experience of the most progressive and wide-awake men of our commonwealth.

Our vast resources from both mountains and plains, our unprecedented industry and our unparalleled prosperity have made the question of public road transportation one of paramount importance.

Thousands of dollars are lost annually, to every community, because of the inadequate facilities of transportation, say nothing of all the inconveniences arising from wrongly located, poorly constructed and improperly maintained public wagon roads.

Heretofore, for the past twenty years, much money and energy has been spent, it would seem at random, without taking into consideration the future, and without acting along any well considered and economically designed plans, that would tend to make each and every dollar invested in road work, let it be for roadway or bridges across streams, a link in a forged chain. The State has acted independent of the county in which any specific road was to be built, and the county has built roads and bridges as it pleased and where it pleased, without the advice or assistance of the State.

Some law should be enacted that would make it a part of the duties of the State Engineer, to give such advice, assistance and supervision, with regard to road and bridge building, improvements to, and maintenance of the same, to the board of county commissioners of the various counties, as time and conditions will permit. Certain important roads that might be designated as main or connecting lines, in each county, should be set apart by the Legislature as State roads. Maps and profiles, showing all work required to make the road eventually, when the work is done, first class, should be prepared, the original to be kept in the office of the State Engineer, a copy to be filed with the county clerk and recorder of the counties in or through which the various portions of the State roads are located.

Should the Legislature wish to give any county State aid to be used on the roads or bridges of such county, the amount should be appropriated without defining the specific location, or kind of work to be done, but be given to the county or counties, to be used in such place or places on some already declared State road, as the State Engineer, acting agreeable to the advice of the board of county commissioners, may select, then to be used only after the board of county commissioners have given satisfactory assurances

that they would provide an equal amount to be used on the same project, on portions in their respective counties, at a like time, to be expended in the same manner and under the same supervision as the State money.

Provisions should be made to allow the State Engineer to be able to gather statistics of the various kinds of roads in the different states of the Union, as to the cost of construction and maintenance of the same.

In the movements for improved conditions of the public roads, much importance is placed upon the question of how to best construct, and it is exceedingly proper that this should be so. However, at the present enthusiastic state of the movement, there would seem to be a strong tendency to lose sight of a question scarcely second in importance to that of construction, it being that of maintenance and repairs. All work to be done on any road previously segregated as a State highway, on which State aid has been expended, be it either that of maintenance or repairs, to be paid for by the State, the county or otherwise, should be done under the instruction of the State Engineer.

As a result of a good roads conference held in Denver, on the 4th, 5th and 6th of December, 1906, there was a legislative committee appointed to draft bills to be presented to the Sixteenth General Assembly, with a request that they be enacted into laws. Such laws to embrace the best features of the good roads legislation enacted by the older and more advanced states of the Union, so far as they are applicable to the conditions as they exist in Colorado, and to the ability of Colorado to take advantage of them. There was a desire on the part of some of the delegates to this conference, that there be a commission created, to take charge of all road matters, both State and county, thus relieving the State Engineer's office from all future labors in this connection.

Should the Legislature see fit to enact such a law with suitable appropriations, it would be a magnificent move to bring about first-class roads in every part of the State, and the above recommendations would be fully as applicable to be embodied in laws to be enforced by a road commission as by a State Engineer.



















CHAPTER III.

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ABSTRACT DECISIONS SUPREME COURT SINCE PUBLICATION OF LAST BIENNIAL REPORT OF THIS OFFICE.

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Brothers vs. Brothers, 29 Colo., Rep. Page 69.

A parole gift of land and the water right with it, and the subsequent entering into possession by the donee, with the knowledge and consent of the donor, and the donee having also erected valuable improvements, and having used the water right with the land, was held to be a sufficiently definite contract between the parties as to both the lands and water right to maintain an action to quiet the title to the same. That the allegation that the plaintiff "is entitled to the said land and premises" was sufficient to put in issue the title to the water right.

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The La Junta and Lamar Canal Co. vs. Hess, et. al., 31 Colo., Rep. Page 1.

The water rights owners under the La Junta and Lamar Canal brought a suit to compel the specific performance of a contract between the said canal company and the water rights owners whereby under certain conditions the title to the canal was to be vested in the water rights owners. Upon a petition of the water rights owners showing that the new company, formed to take the title from the old company as provided in the contract, managed the affairs of the canal against the interests of the water rights owners; the court allowed the water rights owners to form a company of their own to take over the title.

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The Buckers Irrigation, Milling and Improvement Co. vs. The Farmers Independent Ditch Co., 31 Colo., Rep. Page 62.

The Buckers company, having a later decreed priority than the Farmers' Ditch Co., made excavations between sloughs and

lakes, which sloughs and lakes lie near to the South Platte river, the common source of supply for the two ditches.

The Buckers company claimed all the water thus collected. From the evidence adduced at the trial it appeared that through the means of these ditches there had been an "artificial" increase in the volume of water along the course of these excavations, but not an "actual" increase.

Under this evidence the court held that the ditches thus constructed simply intercepted the natural sources of the stream within its natural bed and that there being no actual increase of flow gained by the excavations, no right was gained and the Buckers company was enjoined from diverting this water into their ditch.

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The Great Plains Water Co. vs. The Lamar Canal Co., 31 Colo., Rep. Page 96.

The grantor of the Great Plains Water Co. had obtained a decree of priority ahead of the Lamar company by compliance with a statute of this State, which since the decree and in the former hearing of this suit had been declared unconstitutional. Held that the priority obtained under the now invalid law, was invalid and that subsequent appropriators whose rights are superior if the statute is inapplicable, are in no wise bound by the right claimed by those claiming by virtue of compliance with the invalid law, through a decree under said law.

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Blakely vs. The Fort Lyon Canal Co., 31 Colo., Rep. Page 224.

The canal company had contracted in its deeds of conveyance with the water consumers, that when water rights to the limit of the canal's capacity should be sold, that the title to the canal would vest in the water rights owners.

The canal company sold water in excess of the capacity of the canal, and in this suit to cancel these excess deeds, the court held that the deeds should be cancelled and that the title to the canal vested in the water rights owners at the time deeds to the capacity of the canal had been issued. That those who bought water in excess of the capacity of the canal had no claim against the new company formed to take the title for the water rights owners. Nor was said new company liable for debts contracted by the old company after deeds had been issued to the extent of the canal's capacity.

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The Platte Valley Irrigation Company vs. The Central Trust Company, et. al., 32 Colo., Rep. Page. 102.

Both parties to this suit were parties to a decree by which, prior to this suit, their priorities had been determined. The



Platte Valley Company brought this suit claiming an abandonment by the grantors of The Trust Company. The evidence of abandonment was all to the effect that the abandonment occurred prior to the decree.

Held that the question of abandonment prior to the decree was finally determined in the decree awarding priorities, and that the plaintiff could only complain of an abandonment since the decree by which the water might be lost to the defendant.

Same case holds that one complaining on account of a change in the point of diversion must show in what way he is injured thereby, and to what extent the seepage has been decreased by the change before relief will be granted him by injunction.

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The Farmers High Line Canal and Reservoir Co. vs. White et al., 32 Colo. Rep., Page 114.

Water rights owners from the same ditch and from the same stream may have priorities which will relieve them from prorating with other users from the same ditch in times of scarcity of water.

A decree may be had under the same terms as provided for obtaining priorities for ditches. All users must be made either parties plaintiff or defendant. A ditch company may be enjoined from compelling a prorating where users show a priority over other users from the same ditch.

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The Needle Rock Ditch Co. vs. The Crawford-Clipper Ditch Co. 30 Colo. Rep., Page 209.

Provisions of Statute with reference to appeal from a statutory proceeding to adjudicate priorities of water rights is mandatory, and if not complied with, the appeal must be dismissed on motion. No writ of error will lie.

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The Guthrie Park Inv. Co. vs. Montclair, 32 Colo. Rep., Page 420.

One who obtains his title to water from a ditch company, with restrictions as to its use upon certain lands, can not be divested of his title by a stranger to the contract who buys the land designated as the land upon which the water was to be used.

The title to the water right carries with it the right of possession, and one who buys land upon which water was to be used according to the contract of purchase between a ditch company and the purchaser of the water, can not set up the failure

to perform the contract, and thereby divest the purchaser of his title.

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The Bessemer Irrigation Co. vs. Wooley et al., 32 Colo. Rep., Page 437.

When a court of equity has taken jurisdiction, through injunction, it may enter a decree quieting the title to the water right in question, and no proof of possession is necessary. Title is sufficient proof of possession of a water right.

To pass title to a water right there must be an express grant, or the intention to grant must be made plain from the circumstances surrounding the grant of the land upon which the water is used. Best to have a specific grant.

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Crippen, Trustee, et al. vs. X. Y. Irrigating Ditch Co., 32 Colo. Rep., Page 447.

One who files his claim of priority in a proceeding to adjudicate priorities, is bound by the decree unless within two years from the date of the decree he applies for a review.

One who is not a party to the decree on account of not having filed his claim has four years from the date of the decree to apply for a review.

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Waterman vs. Hughes et al., 33 Colo. Rep., Page 270.

A party to a proceeding to adjudicate priorities filed his claim, but on account of the fact that his ditch was not completed at the time of the entering of the decree was not able to make proof of the amount and the decree as to the amount he was entitled to was left indefinite. Held that the four years period for reopening the decree did not apply, since the decree was made indefinite as to the quantity obtained by the decree.

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City of Telluride vs. Blair, 33 Colo. Rep., Page 353.

An appropriation of water of 140 inches "subject to all prior appropriations" entitles the user to the water when there is sufficient water in the stream for his use above the prior appropriations.

In this case the later appropriation was made by a mill owner for running his mill. Held, that whenever there was sufficient water in the stream to run his mill, regardless of the period of the year, the prior appropriator must allow the amount sufficient to run the mill to go down the stream.

City of Telluride vs. Davis, 33 Colo. Rep., Page 335.

An appropriation of water by two persons jointly, each owning equal shares, and using the water on the separate lands of each is declared to be an appropriation by each separately of one-half of the water.

A grantee of one of the parties under such circumstances may change the point of diversion of the water thus obtained under the same provision that owners of separate ditches may change the point of diversion.

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Fort Lyon Canal Co. vs. Chew, 33 Colo. Rep., Page 392.

The provision of the Statute of 1899 is held in this case to grant no rights relative to the loan or exchange of water which was not recognized before the statute was passed.

A water right is a property right and may be sold or loaned, the point of diversion may be changed, and it may be used on other lands than those upon which the right ripened; but in any of these changes of use he must show that other appropriators are not injured.

A complainant only need allege an injury by the loan or change and the burden of proof is upon the party making the change or loan to show that he is not extending the right which he claims.

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Clark et al vs. Ashley et al., 82 Pac., Page 588.

Ashley claimed the title to the water of a spring arising on his land by prescription, having used it as he claimed for a period of twenty years, for irrigation. The spring was a tributary to a stream from which Ashley and others claimed, and were decreed prior appropriations, within the twenty years time, claimed by Ashley as constituting the period of prescription.

Held that the decree to Clark, et al., within the period of time claimed as the period of prescription, would defeat the title so claimed by Ashley. Also held that even though prior appropriations would take all the water in times of need for irrigation, ahead of one claiming a wrongful diversion by another, this plea would be no defense to the wrongful diversion, since if the water was allowed to flow down the stream, plaintiff would get water sooner than he otherwise would.

Even though the spring flowed to the stream in a subterranean bed, if well defined, the law is the same.

The statute of 1899, relative to the appropriation of spring water arising on the land of one who desires to appropriate it under that statute, does not apply, if, before the passage of that

statute the waters of the stream, of which the spring is a tributary, had been appropriated.

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Smith Canal or Ditch Co. vs. Colorado Ice and Storage Co. et al., 82 Pac., Page 940.

A land owner who collects percolating water on his lands by means of artificial basins, and lets it flow into an irrigating ditch of another, when he has no use for it, does not lose his title to the water by the fact that the ditch company simply passively takes it and uses it even for the period of prescription.

Title by prescription is only gained by adverse possession, for a period of twenty years, with full knowledge, and against the consent of the owner.

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La Jara Creamery and Live Stock Company vs. Hansen, 82 Pac., Page 664.

The plaintiff claimed water arising on its land, claiming it was seepage and waste water. The water arose on the plaintiff's land, however, in the bed of a stream, a tributary to a stream from which there were prior appropriations.

Held, that under the statute of 1899, one cannot make claim to water first arising on his land unless he intercepts it before it reaches the bed of a natural stream, as against prior appropriators.

Second:—That if he claims it as seepage or waste water, he must show that it is such, and the amount thereof.

Third:—That the statute of 1899 only gives the right to collect seepage and waste water, or spring water arising first on the land of the claimant, subject always to the same rules that apply to other appropriations of water.

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Fluke vs. Ford, 84 Pac., Page 469.

A grant in a deed to land reciting and granting, "one-half the water in a certain ditch and all other water owned by the grantor, entitled to flow through said ditch," conveys all the right which the grantor has to any water in said ditch, either by appropriation or otherwise.

This case also holds that even should all parties concerned, as water users, unite in agreeing upon a change in the point of diversion of a water right; nevertheless, they could not thereby bind the state or the officers of the state, who are only bound to



deliver and apportion the water in the various districts according to the decrees of the court.

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Burkart vs. Meiberg, et al., 86 Pac., Page 98.

The plaintiffs and defendants own adjoining tracts of land. The defendants own valid water rights in several ditches which have their headgates in a natural stream, and with the water thus diverted, they had, for a number of years, irrigated their tract of land in question. In the process of spreading water upon it, some of it, the surface drainage, has passed across and escaped therefrom, and reached the land owned by plaintiff, and is there collected by her and by means of an irrigation ditch, running parallel with the common boundary line. She has used this water in raising crops. Plaintiff first began such use about the year 1890 and so continued until the year 1903, when the defendants dug a parallel ditch, entirely upon their own land, a short distance from the boundary line, and thus intercepted the water which had been spread upon their land further to the east, but which, in the process of irrigation, had not soaked into or passed beneath the surface, and the water thus intercepted by the defendants, they carried by means of a ditch around the plaintiff's body of land, and irrigated other lands owned by them to the west of plaintiff's tract.

The question for decision is whether the plaintiff has made a valid appropriation of waste water as against the defendants, or whether the defendants have a right, as against plaintiff, to intercept, upon their own land, and before it passes therefrom, water which has been spread upon the same, but not entirely consumed in the process of irrigation.

It will be observed from the foregoing statement that it is only to such water as has actually escaped from defendants, and reached her own lands, that plaintiff makes claim. Her ditch is built entirely upon her own lands, and the point of diversion of the waste water is also situate thereon, and not on defendant's property.

Held: Plaintiff has acquired no vested right to this water, and can not compel the defendants to apply the waters, the right to the use of which they own, in such a way as that some of it will not soak into their own ground, but escape and pass from the surface on to their lands.

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Hallett vs. Carpenter, et al., 86 Pac., Page 817.

The independent ditch, No. 2, was a mutual ditch owned in common by nine farmers, each owning one-ninth of the water.

Three of the owners sold to appellees 3 1-3 cubic feet, to be deducted from their share, and it was this water which the trial court ordered transferred into the Meadow Glen Ditch.

Court held: That where there is a second user of an appropriation of water, by the owners, the water to which either of the parties is entitled may be changed, both in point of diversion and place of use, unless it injuriously affects the rights of others.

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This is complete up until Dec. 1, '06, with the exception of three cases which are now pending in the Supreme Court on motion for rehearing. Which will possibly be decided during the month of December.

These three cases are No's. 4,776, 4,834, 4,862.



Dam and Outlet Gates, Chambers Lake Reservoir, Water District No. 3.





## CHAPTER IV.

### REPORTS OF DIVISION ENGINEERS, 1905-1906.

#### IRRIGATION DIVISION NO. 1—1905.

Denver, Colorado, November 21, 1905.

To the Honorable T. W. Jaycox, State Engineer, Denver, Colorado:

Dear Sir—Herewith I hand you a summary of water commissioners' reports for the year 1905, and a statement of the amounts of water stored in the reservoirs of the various districts of this division.

The amount of water stored prior to May 1 is shown for all districts, but I have not been able to obtain complete reports upon the amount of water stored during the entire season in districts 3, 5, 6, 23 and 48. The report from district 65 has not yet been received.

The amount stored prior to May 1 is 12,453,941,000 cubic feet.

The amount stored during the entire season and delivered to ditches for irrigation is about 9,000,000,000 cubic feet.

The reports from nine districts show the average depth of water applied to the land during the past irrigation season from ditches, alone, to be as follows:

DIST.	DEPTH	DIST.	DEPTH	DIST.	DEPTH
1	1.12	7	1.6	46	3.5
2	2.85	8	2.1	47	3.1
4	0.90	9	1.7	64	3.0

It is interesting to note that under ditches having late priorities and which had no water for the irrigation of crops after about June 20, the yield of small grains was large in proportion to the amount of water applied to the land. The following are a few examples: On a basis of 100 for the average crop of the district:

The Highline Canal, District No. 8—Closed June 23; small grain, 75 per cent.

The Evans No. 2 Canal, District No. 2—Closed June 29; all crops, 85 per cent.

The Burlington Canal, District No. 2—Closed June 22; all crops, 85 per cent.

The depth of water applied to the land under the Evans No. 2 canal was 1.5 feet; under the Burlington canal, 1 foot.

The first cutting of alfalfa was lighter than usual in all districts.

In general the water supply and all crops have been very good in all districts.

Special mention should be made of the unusual crops of wheat grown on high land without irrigation, these crops yielding from 20 to 50 bushels per acre.

The beet sugar industry, with factories established at Longmont, Loveland, Fort Collins, Windsor, Greeley, Eaton and Sterling, has not only added another lucrative product to the farming industry, but has also doubled the value of the lands in the localities where these factories have been built.

The past season has been remarkable for the unusual amount of snow during the early spring, and of rainfall continuing until about June 1, followed by extreme drouth in the mountain districts, and the failure of the water supply of the mountain streams occurring from two to three weeks earlier than usual.

At an altitude of 10,000 feet on July 20 the snow was all gone in localities where on the same date of 1904 its depth was three feet. Late rains in the mountains seem to have caused the early melting of the snow.

The shortage of water supply beginning about June 15, after the unusually good prospects of the earlier part of the year, is the best argument for and emphasizes the importance of providing for the storage of more water while the surplus lasts.

All water commissioners have been very faithful in the discharge of their duties and general satisfaction has resulted in all districts.

I wish to express my gratitude to yourself and your assistants and to all water commissioners of the division for courtesy and assistance in the supervision of the distribution of water during the past season.

Respectfully submitted,

WM. RIST,  
Division Engineer, Irrigation Division No. 1.

# IRRIGATION DIVISION NO. 1.

## Tabulated Statement of Water Commissioners' Reports—1905.

DISTRICT	Length of Ditches in Miles	Length of Laterals, Miles	No. of Acres-ft. Used by Can- als during season	Total number acres that can be irri- gated	ACRES OF CROPS IRRIGATED.								SPECIAL CROPS.						COST—DOLLARS.		
					Alfalfa	Natural Grasses	Orchards	Cereals	Market Gardens	Sugar Beets	Potatoes	Other Crops	Timothy	Barley	Pears	Cucum- bers	Tomatoes	Total Irrigated	Superin- tendence	Repairs	Improve- ments
1 . . . . .	211	175	92,122	103,885	19,045	13,855	227	17,055	50	6,075	1,465	1,800						82,072	7,875	9,810	1,200
2 . . . . .	311	110	199,666	88,560	23,008	7,131	391	26,837	1,885	5,093	4,653	747				200	425	69,900	11,063	10,735	10,315
3 . . . . .	340	386		193,610	35,810	10,847	3,054	61,292	2,442	24,910	27,428	8,959						174,742	400	200	
4 . . . . .	174	93	86,684	99,019	26,100	2,300	560	46,000	200	13,755	6,750	2,045						99,012	31,770	3,000	4,500
5 . . . . .	240	144	67,972	104,889	26,370	12,900	1,248	51,722	1,214	4,919	2,641	171			2,286			103,599	500	7,133	
6 . . . . .	226	29	73,088	35,810	18,836	13,561	1,902	29,995	1,207	1,764	657	1,610						69,007	6,862	3,490	1,950
7 . . . . .	279		119,750	180,975	28,265	24,650	2,825	27,495	7,460	4,715	1,005	27,085						74,040	10,950	7,545	
8 . . . . .	255	100	67,733	49,679	2,148	1,925	1,586	7,013	2,040	3	8	8,961						37,742	19,106	22,783	250
9 . . . . .	86	77	17,646	10,960	5,491	343	145	4,020	44	29	5	28	315					10,320	2,200	1,035	675
23 . . . . .	306			26,654		26,654							26,654					26,654		7,020	
46 . . . . .	344	20	145,733	79,930		34,330			2		2	19	6,890	323				41,703			
47 . . . . .	267	64	110,415	63,945		41,860		120		5	5		973					44,239		5,030	2,000
48 . . . . .	57		52,565	5,050		2,668		55	2		7							3,603	1,270	1,047	1,638
64 . . . . .	223	335	175,100	109,500	17,235	28,780	223	12,405	6	3,331	4,065	635						58,409	8,567	2,040	
	3,319	1,533	1,208,474	1,152,466	202,308	221,804	12,161	284,009	16,552	64,599	48,691	52,060	8,178	323	2,286	200	425	895,042	100,563	80,868	22,528

[illegible]



The number of acre feet used by canals for the season in districts Nos. 3, 5, 6 and 23 can be shown only in part, the necessary data having been partly omitted in commissioners' reports.

Superintendence and repairs reported for only three ditches in District No. 3, and no improvements reported in same district.

The water of The Laramie River ditch, also of Lost lake and Laramie lake is diverted from district No. 48, and delivered to The Larimer County ditch in district No. 3.

### IRRIGATION DIVISION NO. 1.

#### Tabulated Statement of Water Commissioners' Reports on Water Stored in Reservoirs—1905.

##### RESERVOIRS.

DISTRICT	AMOUNT STORED PRIOR TO MAY 1ST.	AMOUNT STORED DURING SEASON	HELD OVER FROM 1904
1.....	1,452,063,327		230,000,000
2.....	809,349,200	809,349,200	
3.....	2,613,701,000		397,000,000
4.....	978,744,000	1,333,673,000	184,200,000
5.....	1,032,336,555	1,487,032,695	
6.....	656,006,552	656,006,552	
7.....	206,856,855		30,187,000
8.....	454,698,300		
9.....	643,555,700		385,904,400
23.....	3,545,540,000	3,565,676,000	2,104,000,000
46.....	44,319,208	44,319,208	
47.....		No reservoirs in dist.	
48.....	3,702,600	3,702,600	
64.....		No reservoirs in dist.	
65.....	13,068,000	13,068,000	
	12,453,941,297		3,331,291,400

All water stored was delivered to ditches for irrigation excepting that of Cheesman, Marston, Platte Canon and Wellington reservoirs, amounting to 4,026,000,000 cubic feet.

Districts 1, 3, 7, 8 and 9 failed to report amount stored during the season.

Amount of stored water delivered to ditches, about 9,000,000-000 cubic feet.

Denver, September 19, 1905.

Mr. T. W. Jaycox, State Engineer, Denver, Colorado.

Dear Sir—In accordance with your request for information concerning the amount of water held in storage May 1, 1905, also the quantity held over from year of 1904, in the several reservoirs in each district in the division, I submit the following report, compiled from data received from the water commissioners of this division.

I have not been able to learn earlier the amount of water stored in some reservoirs of districts five (5), six (6) and nine (9). There are fifteen small reservoirs in district 9 and a few in other districts concerning which I have not been able to gather the information desired.

Very respectfully yours,

WM. RIST,  
Division Engineer, Division No. 1.

	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 1	Jackson Lake.....	1,002,063,327	230,000,000		
	Riverside .....	225,000,000	None.....		
	Bijou.....	175,000,000	None.....		
	Houston & Boyd.....	50,000,000			
				1,452,063,327	230,000,000
	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 2	Oasis.....	426,349,200			
	Western Land & Investment Co. No. 1.	8,000,000			
	Western Land & Investment Co. No. 2.	10,000,000			
	Western Land & Investment Co. No. 5.	15,000,000			
	Lower Latham.....	303,000,000			
	Bennett & Myers.....	3,000,000			
	Little Western.....	2,000,000			
	Munford.....	4,000,000			
	Rutherford.....	6,000,000			
	Dallinger .....	1,500,000			
	Skell .....	2,500,000			
	Smith .....	10,000,000			
	Higgins.....	18,000,000			
				809,349,200	

	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No 3	Windsor .....	511,000,000	140,000,000	.....	.....
	Claymore Lake .....	30,000,000	.....	.....	.....
	Larimer & Weld. ....	220,000,000	.....	.....	.....
	Cache La Poudre .....	391,000,000	.....	.....	.....
	Warren Lake .....	25,000,000	.....	.....	.....
	Douglas .....	30,000,000	35,000,000	.....	.....
	Long Pond .....	158,000,000	10,000,000	.....	.....
	Lindenmeier Lake .....	25,000,000	15,000,000	.....	.....
	Rocky Ridge .....	176,500,000	.....	.....	.....
	Water Supply & Storage Co. Nos. 2 and 3	10,272,000	.....	.....	.....
	Water Supply & Storage Co. No. 4. ....	37,072,000	.....	.....	.....
	Curtis Lake .....	25,000,000	.....	.....	.....
	Chambers Lake .....	54,857,000	.....	.....	.....
	Reservoirs of N. Poudre Irrigation Co., ..	920,000,000	197,000,000	.....	.....
	.....	.....	.....	2,613,701,000	397,000,000



District	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
No. 4	Lone Tree .....	400,000,000	2,200,000	.....	.....
	Lake Loveland .....	257,000,000	135,000,000	.....	.....
	Lawn Lake .....	35,310,000	8,000,000	.....	.....
	Fairport .....	30,000,000	5,000,000	.....	.....
	Rist & Bennett .....	10,000,000	5,000,000	.....	.....
	Loveland Lake .....	27,434,000	20,000,000	.....	.....
	Louden .....	30,000,000	None .....	.....	.....
	Mariano .....	180,000,000	None .....	.....	.....
	Berthoud Lake .....	9,000,000	9,000,000	.....	.....
		.....	.....	978,744,000	184,200,000

	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 5	Highland Lake .....	4,520,000	None .....	.....	.....
	Highland No. 1 .....	33,889,104	None .....	.....	.....
	Highland No. 2 .....	88,697,117	None .....	.....	.....
	Highland No. 3 .....	186,175,334	None .....	.....	.....
	Knoth .....	89,490,000	None .....	.....	.....
	McIntosh .....	None .....	D'pth 7 ft, quan, unk'wn	.....	.....
	Pleasant Valley .....	D'pth 7 ft, quan, unk'wn	None .....	.....	.....
	Left Hand .....	None .....	None .....	.....	.....
	Lagerman .....	23,537,000	None .....	.....	.....
	Divide .....	39,204,000	None .....	.....	.....
	Beaver Park .....	None .....	.....	.....	.....
	Union .....	566,824,000	D'pth 21 ft, quan, unk'wn	.....	.....
		1,032,336,555	.....	.....	.....

No gage rod in any reservoir in District 5, excepting Beaver Park Reservoir.

	RESERVOIR	AMOUNT STORED *CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 6	Marshall.....	58,767,627	.....	.....	.....
	West Lake.....	30,452,077	.....	.....	.....
	Section 19.....	3,520,389	.....	.....	.....
	Section 9.....	837,427	.....	.....	.....
	Section 15.....	767,954	.....	.....	.....
	On Section 17.....	1,000,000	.....	.....	.....
	On Section 17.....	250,000	.....	.....	.....
	On Section 11.....	900,000	.....	.....	.....
	On Section 35.....	900,000	.....	.....	.....
	Great Western.....	12,916,200	.....	.....	.....
	Hiram Prince No. 1.....	2,358,861	.....	.....	.....
	Green Lee No. 1.....	1,511,133	.....	.....	.....
	Thomas.....	11,027,773	.....	.....	.....
	Lawson Lake No. 1.....	419,095	.....	.....	.....
	Goodhue No. 1.....	435,459	.....	.....	.....
	Hodgson.....	1,875,000	.....	.....	.....
	Burk.....	6,600,000	.....	.....	.....
	J. D. Jones.....	656,500	.....	.....	.....
	Robt. Barnes.....	631,793	.....	.....	.....
	Louisville.....	4,221,588	.....	.....	.....
	Cowdry.....	1,281,450	.....	.....	.....
	J. F. Jones.....	500,000	.....	.....	.....

RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
Goodhue No. 2 .....	1,652,822			
Wm. Wanake No. 1 .....	303,833			
Marfield Lake No. 1 .....	2,567,662			
Marfield Lake No. 2 .....	1,089,800			
Lafayette No. 1 .....	624,685			
Lafayette No. 2 .....	892,600			
Prince No. 2 .....	3,635,910			
Erie .....	5,206,750			
Upper Church .....	14,000,000			
Lower Church .....	20,000,000			
Elmwood .....	6,587,000			
Henry Wanake .....	28,319,000			
Teller No. 1 .....	1,994,720			
Teller No. 2 .....	Not given .....			
Teller No. 3 .....	Not given .....			
Teller No. 4 .....	703,990			
Teller No. 5 .....	2,171,522			
Alfred Peterson .....	433,405			
Mary E. Miller .....	1,499,000			
Harper .....	2,713,450			
John Tavano .....	630,688			
Mesa .....	10,803,335			



Island Lake.....	7,906,508	.....	.....
Silver Lake.....	22,073,092	.....	.....
Goose Lake.....	8,605,645	.....	.....
Stanley & Gaynor.....	43,005,035	.....	.....
Panama No. 1.....	304,920,000	.....	.....
Eggleson, 1 and 2.....	1,280,000	.....	.....
Lake Albion.....	12,127,104	.....	.....
Six Mile.....	7,828,670	.....	.....
Total.....		656,006,552	.....

District No. 7	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
	Hyatt .....	52,272,000	.....	.....	.....
	Broad .....	5,178,000	.....	.....	.....
	Lothrop .....	15,691,600	.....	.....	.....
	Lothrop No. 2 .....	8,712,000	.....	.....	.....
	Galkins .....	13,939,200	.....	.....	.....
	J. F. Church .....	1,742,400	.....	.....	.....
	Williams .....	2,946,000	.....	.....	.....
	Madison .....	4,862,000	.....	.....	.....
	C. L. Myers .....	10,454,400	.....	.....	.....
	John Fray .....	3,846,000	.....	.....	.....
	Jacob Vogel .....	5,630,840	.....	.....	.....
	H. H. Harris .....	4,356,000	.....	.....	.....
	Ed. Croke .....	1,232,180	.....	.....	.....
	J. B. Church No. 1 .....	17,424,000	.....	.....	.....
	J. B. Church No. 2 .....	25,136,000	.....	.....	.....
	J. B. Church No. 3 .....	10,230,000	.....	.....	.....
	J. Brewer .....	2,641,000	.....	.....	.....
	J. B. Smith .....	9,126,000	.....	.....	.....
	L. M. Smith .....	3,049,000	.....	.....	.....
	D. B. Brown .....	2,780,000	.....	.....	.....
	.....	.....	.....	201,248,620	30,187,293

	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 8	Castlewood.....	267,000,000	.....	.....	.....
	Happy Canon.....	145,600,000	.....	.....	.....
	Platte Canon.....	33,290,000	.....	.....	.....
	Fairview.....	8,100,000	.....	.....	.....
	Deer Creek Canon.....	466,000	.....	.....	.....
	Couch.....	213,000	.....	.....	.....
	Wollurst.....	29,300	.....	.....	.....
		.....	.....	454,698,300	.....

District No. 9	RESERVOIR	AMOUNT STORED	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
		CUBIC FEET			
	Kendrick (8) .....	2,613,000			
	Smith .....	6,534,000			
	Daisher .....	6,098,400			
	Ward Kendrick .....	17,424,000	17,424,000		
	Ward .....	41,817,600	41,817,600		
	East Bergen .....	13,939,000			
	West Bergen .....	14,810,400			
	Dean .....	7,840,800	3,920,400		
	Huck .....	3,484,800	1,742,400		
	Lake (15) .....	3,049,200	1,524,600		
	Shephard .....	2,613,600	1,306,800		
	Brooks .....	1,960,200			
	Huck No. 2 .....	1,742,400			
	Cole .....	1,306,800			
	Marston .....	518,221,500	318,168,600		
				643,555,700	385,904,400



	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 23	Lake George.....	31,000,000			
	Cheeseman.....	3,444,000,000	2,071,000,000		
	Wellington.....	33,000,000	33,000,000		
				3,508,000,000	2,104,000,000

	RESERVOIR	AMOUNT STORED CUBIC FEET	HELD OVER FROM 1904 CUBIC FEET	TOTAL AMOUNT STORED	TOTAL HELD OVER
District No. 46	Slack & Wiess.....	1,119,208			
	DeLand.....	2,600,000			
	Two Ledge.....	2,725,000			
	Tom.....	4,375,000			
	Cochrane.....	8,000,000			
	Hills.....	14,000,000			
	Brier.....	6,000,000			
	Bennett.....	5,500,000			
	Total.....			44,319,208	

## THIRTEENTH BIENNIAL REPORT

District	RESERVOIR	AMOUNT STORED	Held over from 1904	TOTAL AMOUNT STORED	TOTAL HELD OVER
		CUBIC FEET	CUBIC FEET		
No. 47	No reservoirs in district .....				
48	Lake .....	3,702,600			
64	No reservoirs .....				
65	Rosencrans .....	13,068,000	13,068,000		



Effect of Wave Action on an Earth Dam.



Showing Effect of Wave Action on Unprotected Embankment—Cache La Poudre Reservoir, Water District No. 3.





## RECAPITULATION.

DISTRICT	AMOUNT STORED CUBIC FEET	AMOUNT HELD OVER FROM 1904, CUBIC FEET
1.....	1,452,063,327	230,000,000
2.....	809,349,200	None
3.....	2,613,701,000	397,000,000
4.....	978,744,000	184,200,000
5.....	1,032,336,555	Unknown
*6.....	656,006,552	None
7.....	201,248,620	30,187,000
8.....	454,698,300	None
†9.....	643,555,700	381,330,600
‡23.....	3,508,000,000	2,104,000,000
46.....	44,319,208	None
47.....	No reservoirs	.....
48.....	3,702,600	.....
64.....	No reservoirs	.....
65.....	13,068,000	13,068,000
Grand Total.....	12,410,793,062	3,344,359,400

\*Made up from amounts claimed by owners but thought by water commissioners to be considerable in excess of true amount.

†Includes Marston Lake not used for irrigation.

‡Includes Cheeseman Lake not used for irrigation.

## IRRIGATION DIVISION NO. 1.

## Annual Report, 1906.

Denver, November 23, 1906.

Mr. T. W. Jaycox, State Engineer, Denver, Colo.

Dear Sir—I hand you herewith tabulated statements of water commissioners' reports.

These reports are not complete, owing mainly to the fact that some of the commissioners do not have enough deputies to enable them to secure such records and information as they must have to make complete reports.

In districts 3 and 4 it has been impossible for the commissioners, without assistants, to keep a record of the amount of water delivered to ditches, on account of the great amount of

exchanged water from reservoirs, and the much complicated system necessary to make the exchange.

The rainfall of this year during the growing season has been greater than usual, and in all districts the crops are largest ever produced in northern Colorado.

Reports from various districts of grain raised without irrigation are as follows:

DISTRICT	ACREAGE	YIELD PER ACRE	AMOUNT	
		BUSHELS	BUSHELS	
1.....	325			
2.....				
3.....	4,500	Average 30	13,500	
4.....	2,152	20 to 55	94,220	Wheat
5.....	1,580	Average 45	71,100	Wheat
6.....	1,500	Average 35		Wheat
		Average 50		Oats
		Average 40		Corn
7.....				
8.....	8,646	20 to 40		Yield of Wheat 20 to 35
9.....	1,215	18 to 40		Yield of Oats as high as 40
64.....	25,000	Average 25	625,000	Corn, wheat and oats
	868	Average 15 tons		Sugar beets

During this year we have had a much better water supply than is usual, with the result that in all districts the late ditches have received water about thirty days longer time than in former years. In districts No. 2 and No. 8 there was water for the late priorities until about July 25, and later in the season all have been well supplied.

In district No. 64 the demand for water for sugar beets caused a shortage in the usual supply for irrigation of crops of grain. Mr. W. L. Henderson, commissioner of district No. 64, says: "My report shows great lack of water to irrigate the increased acreage caused by raising beets and rotating with other crops. Nothing but reservoirs will do us much good. Before our sugar beet industry was started we got along fairly well with water direct from the river, but now the conditions require reservoir water, the same as Fort Morgan and Greeley districts, to water our beet crops."

The great amount of water in the streams during the last two months, the most of which has not been used, shows how greatly the supply for late crops can be increased by the construction of more reservoirs, and it seems that further development of

farming and irrigation interests must depend upon additional reservoirs and increased storage.

In response to your request, water commissioners have given expressions of opinion and recommendations as follows:

Mr. C. I. Colwell, commissioner of district No. 1, suggests "that water districts be made in grades; No. 1 districts where there is a great deal of water stored in reservoirs, where commissioners are on duty the whole year; No. 2 districts, where there is a great deal of irrigation; No. 3, where there is very little irrigation.

Salary in No. 1, \$1,800 per year

Salary in No. 2, \$1,500 per year

Salary in No. 3, \$1,000 per year

and should be paid by State, same as other State officers."

Mr. C. M. Jump, commissioner of district No. 2, says:

"First. I suggest that there be either more stringent laws enacted or more rigid enforcement of the law now existing, preventing the transfer of excess appropriations. During my time in office I have persistently opposed such transfers, and shall continue to do so.

"Second. I recommend that the water commissioners be paid by the State, for the reason that each year more land is put under irrigation and the districts are extending into more counties, making it very difficult, if not impossible, to apportion the pay of the water officers among the counties, to the satisfaction of the counties.

"Third. I recommend the enactment of a law giving the water officers the power and right to determine when a ditch is using more water than actually necessary. There are, to my personal knowledge, several ditches in the district which are so using more water than actually needed."

Mr. J. L. Armstrong, commissioner of district No. 3, recommends that a storage season be established, and the present laws concerning measuring of flumes and headgates, and the determination of capacities of reservoirs on natural streams be rigidly enforced.

Mr. Oswald Allen, commissioner of district No. 4, says:

"I am opposed to a law designating the storage season, as I think it would be an injury to this valley. I believe there should be a law enacted giving the ditch owners the right to store their water in reservoirs, public or private, when a full head of water is not needed in the ditch. In this matter, for one reason especially, I believe it would teach the farmers to use less water on their lands, and I think they would get better results by learning to raise their crops with as little water as possible. Every season

there are hundreds of acres of crops injured by too much water being used. In my opinion there is where the great waste of water is, as many farmers use water when it is not necessary, and also is an injury to their lands and crops."

Mr. W. M. Davis, commissioner of district No. 7, recommends that water commissioners' salaries be paid by the State. Nearly all water commissioners of this division have much trouble to collect their salaries from some of the counties included in their districts, and some have not received considerable portions of their salaries on account of disagreement among the counties interested.

Mr. A. L. Gibson, commissioner of district No. 5; Mr. S. F. Couch, of district No. 8, and Mr. J. W. McLean, commissioner of district No. 9, recommend amendments to the laws providing for payments of water commissioners' salaries, which will insure payment of such salaries, and still not impose injustice upon any of the counties interested.

I wish to thank you and the members of your office and all water commissioners for assistance and courtesies extended to me.

Very respectfully submitted,

WM. RIST,  
Division Engineer, Irrigation Division No. 1.



# IRRIGATION DIVISION NO. 1.

## Tabulated Statement of Water Commissioners' Report, 1906.

DISTRICT	Capacity of Canals	Length of Main Ditch, Miles	Length of Laterals, Miles	Amount of water carried from Reservoir in cubic feet	No. of acre-ft. used by canals during the season	Total number of acres that can be irrigated	ACRES OF CROPS IRRIGATED								SPECIAL CROPS				COST, DOLLARS		
							Alfalfa	Natural Grasses	Orchards	Cereals	Market Garden	Sugar Beets	Potatoes	Other Crops	Timothy	Tomatoes	Peas	Total Irrigated	Superintendence	Repairs	Improvements
1	2,174	191	169	999,300,000	102,364	95,600	18,537	10,610	198	9,922	.....	11,630	594	1,535	.....	.....	.....	44,411	7,185	3,345	18,535
2	2,937	357	452	428,377,000	253,622	91,747	22,615	7,411	397	20,360	1,561	6,072	5,147	1,170	.....	710	.....	74,549	10,035	10,580	9,525
3	.....	383	.....	.....	.....	254,680	44,743	9,608	3,075	87,480	2,311	28,350	27,040	6,415	.....	.....	.....	209,118	.....	.....	.....
4	.....	218	102	Not reported	77,026	104,799	27,100	2,310	624	45,222	220	16,375	0,265	4,291	.....	.....	.....	97,895	20,550	5,225	4,000
5	1,117	240	198	124,806,000	.....	104,625	25,165	11,130	1,446	51,345	1,527	7,860	2,792	1,233	.....	.....	1,780	104,595	6,385	9,105	5,500
6	1,354	197	12	97,809,631	113,048	85,186	19,190	10,534	2,112	31,039	1,400	3,300	298	4,420	.....	.....	.....	73,306	6,830	6,475	20
7	1,099	258	.....	Not reported	162,854	191,425	36,100	4,685	2,825	39,475	8,090	1,305	598	9,005	.....	.....	.....	109,900	17,247	7,638	3,001
8	.....	295	250	Not reported	124,119	106,809	9,993	2,568	1,647	8,425	2,935	200	155	5,050	.....	.....	.....	34,925	11,547	14,753	200
9	541	85	86	Not reported	39,432	13,635	5,817	452	149	4,033	67	29	13	37	359	.....	.....	11,021	2,250	1,765	770
23	.....	205	158	Not reported	.....	.....	.....	34,887	.....	60	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,691	25
46	1,197	288	98	Not reported	128,979	83,790	.....	36,090	.....	409	17	.....	4	.....	9,700	.....	.....	47,880	.....	.....	.....
47	1,367	283	60	Not reported	177,314	64,260	.....	42,300	.....	91	4	3	2	500	160	.....	.....	45,545	.....	5,885	1,000
48	590	58	58	Not reported	50,063	5,070	4	2,608	.....	66	.....	.....	2	.....	.....	.....	.....	3,032	.....	323	7,350
64	3,723	250	278	194,400,000	.....	108,500	16,225	29,620	313	21,430	.....	0,245	832	1,275	.....	.....	.....	65,498	7,855	.....	.....
65	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
	26,105	3,314	1,927	1,844,692,631	1,228,821	1,310,125	225,495	204,907	12,786	328,357	18,132	81,375	43,748	34,937	10,279	710	1,780	921,675	89,884	68,845	49,920



## Amount of Water Stored in Reservoirs—1906.

DISTRICT	AMOUNT STORED	AMOUNT STORED
	PRIOR TO MAY 1ST	DURING SEASON
1.....	1,800,000,000	1,800,000,000
2.....	766,349,300	766,349,300
3.....	.....	4,549,096,000
4.....	695,000,000	1,287,000,000
5.....	851,000,000	851,000,000
6.....	656,000,000	656,000,000
7.....	400,000,000	600,000,000
8.....	179,356,000	186,500,000
* 9.....	1,159,060,000	1,205,452,000
†23.....	3,565,638,000	3,565,638,000
46.....	.....	.....
‡47.....	.....	.....
*48.....	.....	.....
64.....	500,000,000	630,000,000
65.....	.....	.....
	10,585,471,300	16,110,103,300

\*Includes Marston Lake owned by Denyer Union Water Co.

†Includes Cheesman Lake owned by Denver Union Water Company, the greater portion held over from 1905.

‡No reservoirs in district.

## IRRIGATION DIVISION NO. 2.

## Annual Report, 1905.

Pueblo, Colorado, November 22, 1905.

Hon. T. W. Jaycox,

State Engineer,

Denver, Colorado.

Dear Sir—I herewith submit my annual report. In doing so I regret very much that I am not in possession of sufficient data to furnish you such facts and figures as would make it interesting and valuable for future reference.

Having been appointed to the office since the busy season ended, I have few troubles to relate and am too new to give advice. I have relied upon the reports of the water commissioners in my division to furnish information from which to make my report, but while in most instances they have given reliable and complete tabulated reports, most of them have

failed for some reason to add to that information by rendering a written statement of conditions in their various districts.

In the tabulated reports of the commissioners I note that but one of them has even attempted to give the number of miles of lateral ditches, and on inquiry am told that they have no way of getting this information reliably, and that even the owners of ditches can only estimate it.

Commissioners generally have little complaint to make of the treatment accorded them by owners of water rights, but I find that in some districts water users look upon a water commissioner as if he were an interloper and meddler with their rights.

One commissioner complains that in his district the custom has been, when the commissioner closed a headgate, for the owner to follow him up and immediately open it, that there are but few headgates in the district and practically no gauges or rating flumes, and that even the county commissioners paid no attention to him when he requested that they put in a suitable and legal headgate at the head of the County ditch. I hope to see a change in this district for the better during the coming season, as we hope to convince these people that the interest of the water users can be better served by a proper observance of the law.

Because of the very generous snow fall in the mountains during the winter and spring of last year, the streams were better supplied with water during the past season and more water was stored than in any previous year, in consequence better and larger crops were raised in the Arkansas valley than in preceding years.

Hail storms in some sections did considerable damage and in the early part of the season partially destroyed the early cutting of alfalfa, but from an agricultural point of view the season of 1905 was a very prosperous one.

The raising of sugar beets in the Arkansas valley has received additional encouragement by the building of two new sugar factories during the year, one at Lamar and the other at Holly. These factories are now both completed and in active operation, so that the valley now has four modern, up-to-date sugar factories, the others being located at Rocky Ford and Sugar City.

The farmers are finding that sugar beets are one of the most profitable crops that can be raised, and in consequence are increasing the acreage every year, the number of acres planted to beets this year being 27,076.

There has been but little litigation over water rights this year in division No. 2, the only cases being requests for decrees to change the point of diversion of water. The most notable of which is that of the Colorado Fuel & Iron Company to change



the point of diversion of 70 second-feet of water, brought by it from the Arkansas Valley Water Company, from its former point of diversion in the Arkansas river, about 20 miles below the city of Pueblo, to a point about 50 miles up the river, near Portland, Colorado.

In this case the water users contended that such a change would be detrimental to their interests because of the fact that only a small portion of the water decreed had formerly been applied to the land for which it had been decreed, and that junior rights below had had the benefit of all of such decree not applied to the land, which would not be the case if the transfer was permitted.

The petition was granted, however, and the ditch to carry the water from the new point of diversion to the plant of the Colorado Fuel & Iron Company is now being constructed. This case is interesting because of the fact that while the water in controversy was formerly decreed to be applied to lands for agricultural purposes it is now to be used in manufacturing.

A decision of the Supreme Court handed down this year reversing a decision of a lower court in the case of the Ft. Lyons Canal Co. vs. E. R. Chew et al., while not deciding the point as to whether water may or may not be loaned, does explode the theory that water may be loaned at will without consulting the interests of other rights on the stream.

I have been unable to obtain data giving the amount of storage of all of the reservoirs of the district, but I wish to quote from the report of Water Commissioner S. W. Cressy of District No. 17, which it seems to me covers the ground very carefully as far as most of the reservoirs of the lower part of the valley are concerned: "There are only three systems of reservoirs completed and in active operation in District No. 17, although there is one more under construction. The one in operation is the Holbrook, which has an available capacity of 4,200 acre feet. This reservoir can be filled twice a year, winter and summer, if necessary, which makes it available for 8,400 acre feet each year, but on account of the abundance of water the past year they have not been compelled to use its full capacity, as they are so situated that they can use water directly from the Holbrook ditch without having to use reservoir water when there is plenty of water in the river.

They have during the past year used about 4,200 acre feet, and had left in the reservoir on October 1, 1905, 1,800 acre feet.

The Great Plains Reservoir system comprises a group of four district reservoirs, which may be emptied from one to the other, named as follows, commencing with the lower reservoir, Queen, Neenoshe, Neegranda and Neesopah. The Kicking Bird canal is about 40 miles long and is taken out of the Ft. Lyons canal about 40 miles from the river.

The Great Plains Reservoir Company have enlarged the Ft. Lyons canal from the river to the head of the Kicking Bird canal.

The capacity of the reservoirs in acre feet in the order given is Queen, unavailable 9,939, available 30,312; Neenoshe, unavailable 21,485; available 63,052; Neegranda, unavailable 39,860, available 50,910; Neesopah, unavailable 10,908, available 23,464.

As will be seen, it takes a great amount of water to fill the unavailable capacity before any can be used. On October 1, 1904, the Queen had 20,523 acre feet of available, of which, under agreement with the Ft. Lyons Canal Company, 5,483 acre feet each year is to be delivered to lands under the Ft. Lyons canal. October 1, 1904, Neenosha had stored 11,963 acre feet of available and some water in the unavailable of Neegranda, but the records do not give how much.

Oct. 1st, 1905, Queen had in acre-feet available water .....	23,020	
Oct. 1st, 1905, Neenoshe had in acre-feet available water.....	31,515	
Oct 1st, 1905, Neegranda had in acre-feet available water.....	24,571	
A total.....		79,106

The unavailable capacity of Neesopah has not been filled and no record of what has been run into it has been kept.

The amount of water delivered to the head of the Kicking Bird canal from the Ft. Lyons canal in acre feet for each month is as follows:

1904	
October .....	21,939 .18
November.....	5,555 .70
December.....	14,380 .16
1905	
January.....	841 .98
February.....	920 .33
March.....	35,270 .00
April.....	
May.....	19,346 .77
June.....	28,976 .52
July.....	3,157 .68
August.....	5,593 .39
Total .....	139,511 .44

The Box Springs reservoirs which are situated on the west side of Horse creek and about 12 miles north of Sugar City, receive their water from Horse creek through a supply ditch with an estimated carrying capacity of 360 second feet. The capacity of the reservoirs are 3,392 acre feet, from which 4,000 acres of good land can be irrigated.

There was stored during 1905 2,000 acre feet, of which 900 acre feet was used on 180 acres alfalfa, 20 acres sugar beets, 10 acres of orchard and 420 acres of other crops."

Taking it all in all, the present season has been the best in the history of the Arkansas Valley for agriculture interests, not only because of plenty of water in the streams, but because farmers are learning better and better each year how to do intelligent farming as well as to store and preserve for use the moisture that has heretofore gone to waste.

Irrigation Div. Eng., Div. No. 2.

Respectfully submitted,

JOHN M. JACKSON,

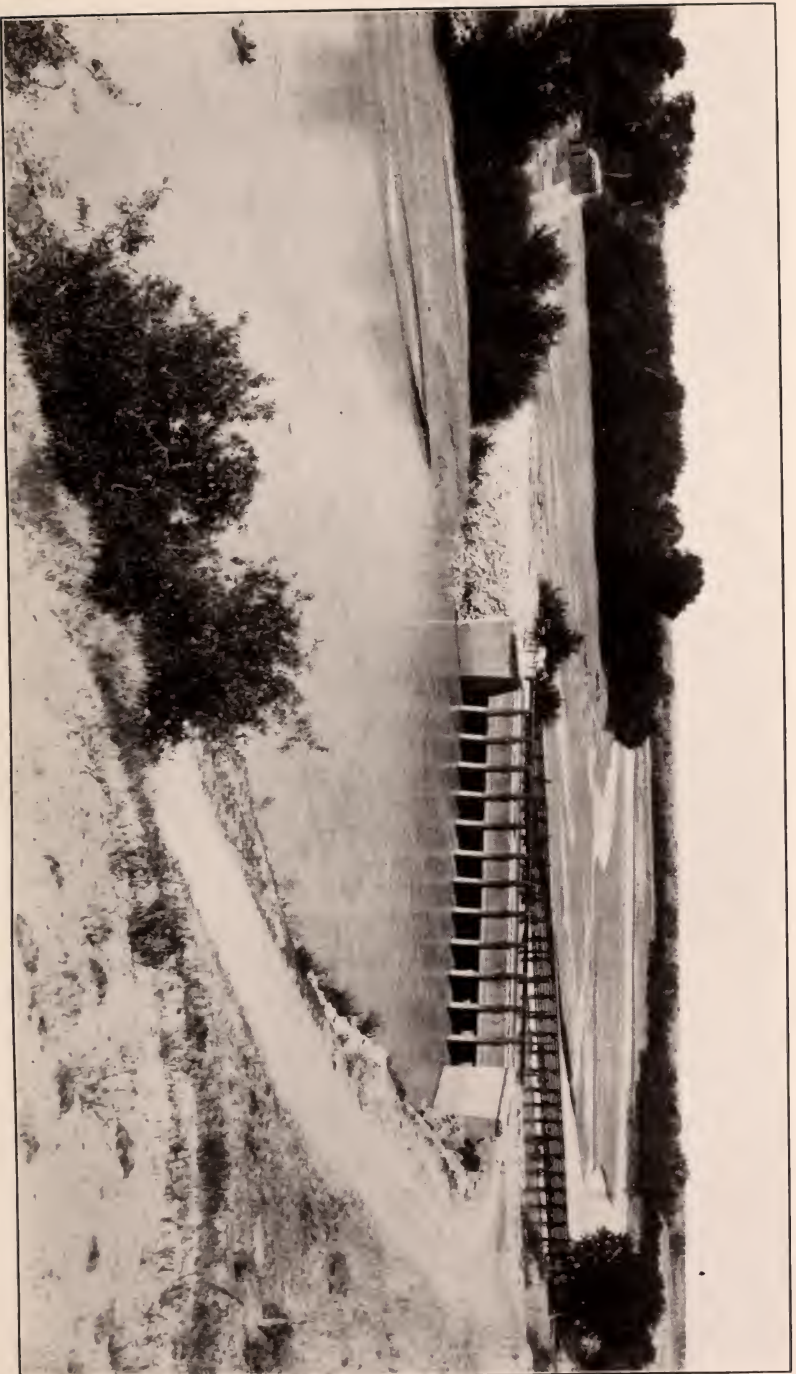
## IRRIGATION DIVISION NO. 2.

SUMMARY OF WATER COMMISSIONERS' REPORT, A. D. 1905.

District No.	Length of Main Ditch, Miles	Length of Laterals, Miles	Av. daily amount of water during season, sec. ft.	Total number of acres that can be irrigated	No. of acres of alfalfa	No. of acres of natural grass	No. of acres of orchard	No. of acres of cereals	No. of acres of market gardens	No. of acres of sugar beets	No. of acres of potatoes	No. of acres of other crops	Total No. of acres irrigated
10	99	.....	259.25	7,354	3,221	672	245	.....	.....	.....	.....	3,216	7,354
11	320	.....	540.00	35,397	5,299	6,179	96	5,285	111	.....	382	1,961	21,261
12	270	.....	376.17	19,798	65,115	1,432	3,476	808	44	.....	.....	2,208	14,481
13	125	.....	.....	14,169	1,060	8,754	.....	.....	10	.....	10	4,344	14,169
14	238	.....	194.50	142,205	24,318	25,607	5,143	11,037	1,920	10,610	120	8,205	82,003
15	108	.....	108.74	9,340	3,898	1,595	202	.....	.....	.....	.....	1,251	6,946
16	.....	.....	551.50	32,129	19,500	4,369	114	2,610	26	.....	.....	1,972	28,272
17	361	.....	1129.00	143,332	67,545	1,790	3,619	.....	.....	11,389	.....	37,126	110,080
*18	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
19	.....	.....	74.50	8,750	3,655	250	135	80	.....	.....	.....	815	4,800
*49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
*66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
67	216	296	308.30	113,850	24,690	750	1,169	9,075	.....	5,077	.....	9,575	49,555
	1,737	296	3,541.76	526,924	218,301	51,398	14,199	28,895	2,111	27,076	512	70,673	338,921

\* No Report.





Arkansas River, Dam, Head Gate and Drift Fence of Fort Lyon Canal, Water  
District No. 17.



## IRRIGATION DIVISION NO. 2.

Annual Report, 1906.

Hon. T. W. Jaycox,  
State Engineer,  
Denver, Colorado.

Dear Sir:—I have the honor to submit herewith my annual report for the year 1906, together with the reports of the several water commissioners of this irrigation division.

I regret to say that some of the commissioners failed to reply to my urgent request to supplement their tabulated statements with written reports, but some of those who did, responded with reports so complete and full of information, that I am submitting them to you in their entirety, with the hope that you may find a place for them in your biennial report to his Excellency the Governor.

As is usually the case, the unexpected happened in the Arkansas valley this season and in many respects we have had a phenomenal year from an irrigation standpoint.

It was quite generally predicted, early in the season that there would be a shortage of water. The farmers of the Arkansas valley have long since by experience, learned not to depend upon signs and predictions and that he who plants his crops and industriously tills them according to scientific rules of farming, keeping continuously in touch with water conditions, always keeping his ditches in good order, ready to put water to its best use, when it is to be had, is the successful farmer, without regard as to whether there is a great plenty of water or not; following out this policy and aided by the plentiful and unexpected supply of water, the farmers of the Arkansas valley have as expressed by one of the prominent farmers of the valley "The biggest and best crops that have ever been raised."

The total acreage, irrigated in this division for the year as shown by the compiled reports of the water commissioners, is 376,734 acres, while the report of the year 1905 gave 338,921 as the total irrigated, showing an increase for this year over last of 40,000 acres in round numbers.

The tilling of sugar beets has grown in favor with the farmers, as attested by the number of acres raised this year. The report of 1905 shows that there were raised 27,076 acres, and that of 1906 an acreage of 46,668, an increase of about 72 per cent over last year. The indications are that a much larger acreage of this crop will be planted in 1907. A new sugar beet factory with a daily capacity of 1200 tons has just been completed at Swink and another has been contracted for at Las

Animas, to be completed in time to take care of the crop of 1907

The only decrease shown in the report of 1906 is in the number of acres of alfalfa raised. The report of 1905 shows 218,301 acres raised while that of 1906 gives 163,464 acres, a decrease of 55,000 acres in round numbers; this is accounted for, however, in the increased acreage in sugar beets and cereals for this year.

The year 1905 was considered a banner year for irrigators along the Arkansas river and its tributaries and the aggregate flow for the season probably very largely exceeded that of the season of 1906; but this year the flow of water has been more evenly distributed throughout the season and has furnished a larger number of ditches with a constant flow of water.

No high or destructive floods have occurred, resulting in the destruction of dams and headgates, thereby putting canals out of commission and preventing the running of water at a time when it was most needed. The rainfall has been large and well distributed throughout the season. The conditions prevailing on the Arkansas river have largely obtained on the tributary streams and the crop reports are generally gratifying.

While there has been no exceedingly high water or great floods available for storage purposes, owing to the copious rains and high general average of the river flow there has been an ample supply of water for storage reservoirs at periods throughout the season.

Something of the value of these storage reservoirs as a supplemental supply for irrigating crops may be obtained from the report of Water Commissioner E. M. Mears of District No. 67, in which he states in substance that there are available in the reservoirs of the Arkansas Valley Sugar Beet and Irrigated Land company at the present time about 122,000 acre feet and that there is enough water in these reservoirs at the present time to more than irrigate the 30,000 or more acres in cultivation under the Amity Canal, next season, even if the direct supply from the river were entirely cut off.

As another instance of the benefit of conserving water in storage reservoirs is that of the Twin Lakes Reservoir company whose reservoirs are located high up in the mountains near Granite on a tributary of the Arkansas river. This company uses the Arkansas river as a means for conveying water from this reservoir to the headgate of the Colorado Canal when the water is needed to supplement the supply taken from the river by this canal.

The report of Water Commissioner R. B. Burton of District No. 14 shows that water has been used from this reservoir for 51 days during the past season, delivering to the Colorado Canal during that time an average of 237 cubic feet per second of time



or a total 24,174 acre feet and yet the gauge in the reservoir shows almost two feet in depth more of water than at the beginning of the season. Some idea of the volume of water still remaining in this reservoir may be had from the statement that the gauge in the reservoir on October 31 of this year shows a depth of 23.42 feet of water and that the reservoir covers more than 2,000 acres in area.

There are many other reservoirs in this irrigation division all of which have shown equally good results as the reports of the several water commissioners attest.

The great demand for irrigated lands in Colorado is stimulating new water enterprises and many filings have been made for reservoir sites. The Colorado Fuel and Iron Company has been engaged in constructing a ditch from a point on the Arkansas river about four miles above the town of Portland to their steel works in Pueblo, a distance of about 34 miles. Owing to the contour of the surface over which this ditch is constructed it was necessary to build several miles of siphons and do a large amount of concrete work, necessarily making it one of the most expensive ditches in the state. It is reported that when completed the cost will approximate \$1,000,000. This ditch is calculated to carry 70 second feet of water purchased from the Arkansas Valley Ditch Company and decreed to be diverted to this ditch when completed, and also water from the Sugar Loaf reservoir located near Leadville.

Early in the season Commissioner William Young of district No. 11 reported that there were very few headgates and rating flumes in his district, and asked for instructions. About 125 notices were sent to him calling attention of ditch owners to the section of the statutes requiring headgates and rating flumes, and these notices were served upon the delinquents; after persistent and determined effort on the part of the commissioner, he reports that the notices have been quite generally complied with and that the ditches in his district will be in good shape for receiving water the coming season.

We have had few controversies with ditch owners over the enforcement of the laws; where any such controversies have arisen it has been usually through a lack of knowledge of the law on the part of the ditch owner and in these cases we have been able to adjust the grievance in an amicable and satisfactory manner.

A few arrests have been reported by water commissioners of parties for stealing water and in all of these cases where prosecutions were pushed, convictions were had and the lesson generally sufficient to stop further pilferings of water.

Following out the idea that publicity promotes harmony, where the public servant is concerned, and that the fullest and most satisfactory results may be obtained when the users of

water for irrigation purposes are in close touch with river conditions, it was decided with the assistance and co-operation of the state engineer and the Arkansas Valley Ditch Association and the water commissioners of this division to issue a daily report on the conditions of the Arkansas river during the busy part of the irrigation season. This was done, the first report being issued on the evening of May 15, and one gotten out each day thereafter up to and including September 30, four months and a half in all.

These reports included the gauge readings of the river at Canon City, Pueblo, Nepesta, La Junta and Lamar, also reports on the larger and more important sidestreams from Canon City to the Kansas line; it also included gauge readings of the Sugar Loaf reservoir at Leadville and the Twin Lakes reservoir at Granite, and also the volume of water carried by the different ditches and canals from the river. This information was obtained by telephone through the water commissioners of districts Nos. 12, 14, 17 and 67 and government observers. The reports on the reservoirs was obtained from the reservoir caretakers, verified from time to time by the commissioner of the district in which they are located. From this information reports were made up and carbon copies mailed each evening to the state engineer, the water commissioners and the several ditch owners along the river so that they were in the hands of these parties in the early morning of the day following, thus giving them as full and accurate information of river conditions as were in the division engineer's office.

The benefit of this information can better be understood, perhaps, when it is known that the scope of territory covered by this report was about three hundred miles in length and that under ordinary conditions that it takes the water passing Canon City about one day to reach Pueblo, three days to reach La Junta and five days to reach Lamar. In flood seasons in particular is this information valuable to water users, as they are advised of coming floods in ample time to have their ditches in shape to make the largest use of it.

This system of daily reports was not first looked upon with great favor by some of the ditch owners, as it was not thought that the information would be sufficiently accurate to make it of especial value, but thanks to the untiring and careful aid of the water commissioners and others of those districts from which the information was gathered, we were able to issue these reports every day during the four and one-half months and I think it is safe to say that of all of those who had the benefit of them, that not one would be willing to dispense with them another season if they could be obtained. In addition to the direct benefits derived from these reports, if the system is continued for a number of years the statistical value will be inestimable to the irrigation interests of the state.

It is needless to say that these reports could not have been issued had the entire expense fallen upon the division engineer's office, as the appropriation of \$500 has usually not been ample to defray the ordinary expenses of the office. The Arkansas Valley Ditch Association, recognizing the benefit to water consumers, assumed to pay the extra expense connected with issuing these reports. The expense for the four and one-half months they were issued is as follows:

Clerk hire .....	\$225 .00	
Special observers .....	104 .40	
Telephone tolls .....	159 .10	
Stationery and printing .....	31 .00	
Total .....		\$519 .50

Inasmuch as the great growth of the farming industry of the state is demanding and will continue to demand the utilizing of every drop of water available for irrigation purposes, we believe it is only justice to this great industry which is of so much importance in the upbuilding of our great state, that the legislature should increase the appropriation for expenses of the irrigation officers, so as to provide sufficient funds to cover all expenses necessary in the discharge of their official duties. Our experience with the daily reports leads us to unhesitatingly say that they are almost indispensable to the best interests of irrigation in the Arkansas valley and I believe would be of equal value in other irrigation divisions if once put in use. I am strongly of the opinion that a bill should be passed by the next legislature increasing the expense fund of the division engineer, so that these reports may be issued for at least six months during irrigation season and paid for out of the funds of his office, so that he may act independent of all interests and give the reports the largest and fullest circulation.

My attention has frequently been called, on my trips up and down the Arkansas river, to the inconvenience occasioned to users of water for domestic purposes by the pollution of the stream caused by the emptying of tailings from hydraulic mining near Granite, Colorado. While this is not a subject that has directly to do with the distribution of water, one can but wonder that the thousands of inhabitants who depend upon this river for domestic water should tolerate it. Immediately above the point where these tailings are emptied into the river it is an ideal mountain stream whose waters are as clear and pure as crystal, while they are dark and murky and unpleasing to the eye below this point, and this in itself ought to be sufficient reason for abating this nuisance without going into the question of the adaptability of the water for domestic purposes.

If the laws are not broad enough to cover cases of this kind, it is surely imperative that such a law be passed by the next legislature.

In closing, I wish to thank you for the many courtesies extended me through your office and also to thank the water commissioners of my division for the able assistance they have rendered me in the discharge of my official duties.

Respectfully submitted,

**JOHN M. JACKSON,**

Irrigation Division Engineer, Division No. 2.

Pueblo, Colo., Nov. 30, 1906.



# IRRIGATION DIVISION NO. 2.

## Tabulated Statements of Water Commissioner's Reports, 1906.

District No.	Amount of Appropriation, sec. ft.	Capacity of Canal	Length of Main Ditch, Miles	Length of Laterals, Miles	Average No. of days water carried from natural streams	No. of days water carried from reservoir	Amount of water carried from reservoir, cu. ft. per sec.	Av. daily amt of water during season, sec. ft.	No. of acre-ft. used by canals for season	Total No. of acres that could be irrigated	CROPS IRRIGATED FROM CANALS IN ACRES.										Superintendence	Repairs	Improvements
											Alfalfa	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Sugar Beets	Other Crops	Total Irrigated				
10	325.38	.....	95.00	.....	143	8	20	203.00	.....	10,332	3,372	4,663	1,730	185	72	.....	306	4	10,332	.....	.....	.....	
11	818.79	793.00	321.00	380.00	115	.....	.....	497.53	.....	35,483	5,338	9,188	4,407	231	188	466	88	4,436	24,317	.....	1,117	575	
12	502.73	.....	204.46	62.24	96	.....	.....	287.85	79,601	20,528	7,329	1,779	250	3,524	93	28	9	3,273	16,285	3,785	5,140	525	
13	184.39	.....	590.25	.....	83	.....	.....	116.39	.....	9,407	440	6,350	2,600	.....	15	2	.....	.....	9,407	.....	.....	.....	
14	1,923.20	2,272.30	276.50	95.00	127	51	237	766.50	262,817	132,220	33,044	10,664	12,528	5,667	1,839	210	15,335	9,485	89,132	10,075	11,310	9,702	
15	135.95	254.70	323.00	.....	98	.....	.....	91.21	.....	9,794	3,668	1,635	910	177	1	3	15	370	6,780	.....	3,446	.....	
16	552.50	1,376.00	349.50	214.00	47	28	42	483.00	2,760	26,531	15,837	4,882	4,623	189	16	4	.....	320	25,871	.....	3,410	583	
17	2,494.08	3,618.54	327.10	1,134.00	101	.....	.....	1,106.00	294,473	144,932	59,945	1,896	26,308	3,620	248	35	24,300	8,589	124,940	17,600	16,525	20,500	
18	80.33	.....	46.25	.....	38	.....	.....	35.01	.....	3,485	1,203	732	.....	31	.....	12	.....	1,173	3,151	.....	.....	.....	
19	461.10	194.00	90.00	55.50	136	.....	.....	164.00	32,540	37,175	8,003	3,935	2,295	186	490	9	.....	388	15,306	.....	7,574	.....	
*49	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
*66	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
67	978.42	.....	217.00	206.50	125	11	1,650	229.00	935,101	113,850	24,930	3,700	11,400	643	.....	50	6,615	3,875	51,213	9,200	2,050	12,750	
Totals.....	8,456.87	8,508.54	2,840.06	2,147.24	.....	.....	.....	.....	1,607,292	533,737	163,464	49,424	67,051	14,453	2,962	799	46,668	31,913	376,734	40,660	50,592	44,636	

\*No commissioner.

# TABLE 1. - SUMMARY OF DATA FOR THE 1950-51 FISHING YEAR.

Source: U. S. Fish and Wildlife Service, Bureau of Fisheries, Washington, D. C.

State	Year	Number of boats	Number of fisherman	Number of boats	Number of fisherman	Number of boats	Number of fisherman
Alaska	1950	100	100	100	100	100	100
Alaska	1951	100	100	100	100	100	100
Alaska	1952	100	100	100	100	100	100
Alaska	1953	100	100	100	100	100	100
Alaska	1954	100	100	100	100	100	100
Alaska	1955	100	100	100	100	100	100
Alaska	1956	100	100	100	100	100	100
Alaska	1957	100	100	100	100	100	100
Alaska	1958	100	100	100	100	100	100
Alaska	1959	100	100	100	100	100	100
Alaska	1960	100	100	100	100	100	100
Alaska	1961	100	100	100	100	100	100
Alaska	1962	100	100	100	100	100	100
Alaska	1963	100	100	100	100	100	100
Alaska	1964	100	100	100	100	100	100
Alaska	1965	100	100	100	100	100	100
Alaska	1966	100	100	100	100	100	100
Alaska	1967	100	100	100	100	100	100
Alaska	1968	100	100	100	100	100	100
Alaska	1969	100	100	100	100	100	100
Alaska	1970	100	100	100	100	100	100
Alaska	1971	100	100	100	100	100	100
Alaska	1972	100	100	100	100	100	100
Alaska	1973	100	100	100	100	100	100
Alaska	1974	100	100	100	100	100	100
Alaska	1975	100	100	100	100	100	100
Alaska	1976	100	100	100	100	100	100
Alaska	1977	100	100	100	100	100	100
Alaska	1978	100	100	100	100	100	100
Alaska	1979	100	100	100	100	100	100
Alaska	1980	100	100	100	100	100	100
Alaska	1981	100	100	100	100	100	100
Alaska	1982	100	100	100	100	100	100
Alaska	1983	100	100	100	100	100	100
Alaska	1984	100	100	100	100	100	100
Alaska	1985	100	100	100	100	100	100
Alaska	1986	100	100	100	100	100	100
Alaska	1987	100	100	100	100	100	100
Alaska	1988	100	100	100	100	100	100
Alaska	1989	100	100	100	100	100	100
Alaska	1990	100	100	100	100	100	100
Alaska	1991	100	100	100	100	100	100
Alaska	1992	100	100	100	100	100	100
Alaska	1993	100	100	100	100	100	100
Alaska	1994	100	100	100	100	100	100
Alaska	1995	100	100	100	100	100	100
Alaska	1996	100	100	100	100	100	100
Alaska	1997	100	100	100	100	100	100
Alaska	1998	100	100	100	100	100	100
Alaska	1999	100	100	100	100	100	100
Alaska	2000	100	100	100	100	100	100
Alaska	2001	100	100	100	100	100	100
Alaska	2002	100	100	100	100	100	100
Alaska	2003	100	100	100	100	100	100
Alaska	2004	100	100	100	100	100	100
Alaska	2005	100	100	100	100	100	100
Alaska	2006	100	100	100	100	100	100
Alaska	2007	100	100	100	100	100	100
Alaska	2008	100	100	100	100	100	100
Alaska	2009	100	100	100	100	100	100
Alaska	2010	100	100	100	100	100	100
Alaska	2011	100	100	100	100	100	100
Alaska	2012	100	100	100	100	100	100
Alaska	2013	100	100	100	100	100	100
Alaska	2014	100	100	100	100	100	100
Alaska	2015	100	100	100	100	100	100
Alaska	2016	100	100	100	100	100	100
Alaska	2017	100	100	100	100	100	100
Alaska	2018	100	100	100	100	100	100
Alaska	2019	100	100	100	100	100	100
Alaska	2020	100	100	100	100	100	100
Alaska	2021	100	100	100	100	100	100
Alaska	2022	100	100	100	100	100	100
Alaska	2023	100	100	100	100	100	100
Alaska	2024	100	100	100	100	100	100
Alaska	2025	100	100	100	100	100	100
Alaska	2026	100	100	100	100	100	100
Alaska	2027	100	100	100	100	100	100
Alaska	2028	100	100	100	100	100	100
Alaska	2029	100	100	100	100	100	100
Alaska	2030	100	100	100	100	100	100

Source: U. S. Fish and Wildlife Service, Bureau of Fisheries, Washington, D. C.

## IRRIGATION DIVISION NO. 3.

Annual Report, 1905.

Saguache, Colo., Nov. 20, 1905.

Hon. T. W. Jaycox,

State Engineer of Colorado.

Dear Sir—In submitting to you my annual report as Irrigation engineer of the Rio Grande Division No. 3, I beg to hand you the reports of the several water commissioners, together with my tabulation of the same, as a part thereof.

The irrigation season of 1905 has been one long to be remembered for its high stages of water in all streams of this division. During the month of June the Rio Grande reached the gage height of over 10,000 cubic feet per second and, after remaining at that height for several days, the rod was swept away so that we got no further readings during the flood.

Of this vast amount of water, barely 4,000 feet could be utilized for irrigation and the balance ran to waste for several weeks, thus showing the need of storage reservoirs on this watershed.

All smaller streams had similar floods, but in most cases, they did not run to actual waste, but filled all lower basins and sinks to an extent not known for years.

These conditions extending well into the season, water commissioners were not obliged to put on their full number of deputies, and generally but little trouble arose in the distribution of water.

District No. 20—The water commissioner of this district, Mr. G. C. Wiedman, has filled the position for two terms. He has found use for but one deputy for a part of the season only, and has been very successful in handling the waters of the Rio Grande.

District No. 21—The old commissioner, Mr. G. S. Lovett, has held over here. He has gotten along with but little friction and makes a very complete report.

District No. 22—Mr. J. C. Dalton, the commissioner is very sick and, I am sorry to say, unable to report.

District No. 24—Mr. J. P. Sanchez was a new appointment here, but he has been a hard worker and makes a careful report.

District No. 25—Mr. Frank Cargo has handled the water in this district in a very satisfactory manner.

District No. 26—Mr. W. R. Donnell was re-appointed as water commissioner in this district, and although during the latter part of the season water has been very short in the Saguache, but few disputes have arisen and the water has been made to do full duty.

District No. 27—The new commissioner, Mr. Feles Chavez, has had no trouble with the water users in this district.

District No. 35—The old commissioner holds over, but he has not been called into active service and has never made any report.

I have personally been in the field with the commissioners several times during the season, making measurements and helping to settle disputes wherever they have arisen. We have done away with the loaning of water altogether, and have had no serious litigation to contend with.

In tabulating the reports of the water commissioners I find that all but one are on the blanks formerly used, hence do not include dates of first and last use of water, special crops, etc., so that the footings only show for what headings appear on the old forms.

Peas have become the leading crop in this division, especially in the sub-irrigating sections, where something like 40,000 acres were raised this season.

About 320,000 lambs have been put on these pea fields to be fattened for the eastern markets, where they compete successfully with the corn-fed product. Where the pea crop has been sold as it grows on the ground, feeders are paying from five to ten dollars per acre for it. In many cases one man makes the crop on two or three quarter sections, with no harvesting to do, as the lambs are simply herded in the fields.

Storage reservoirs have been agitated to a marked extent this season. Mass-meetings were held and congressmen importuned to secure the dissolution of the injunction restraining reservoir filings on the Rio Grande water-shed.

A commission, appointed from the several counties of the division, has been investigating reservoir sites and gathering data to place before the government reclamation service. In fact, everything is in readiness to go ahead with several large undertakings, provided the government will allow active work to commence.

But one large project is at present being carried forward—that on the Alamosa, which, when I visited it in the latter part of the season was being pushed successfully toward completion.

Let me assure you that all commissioners have taken a deep interest in their work and are in full accord with you in your administration of irrigation affairs, and, with the expectation of having satisfactory field books for next season, with a careful and complete memoranda kept by the commissioners throughout the year, I trust that all reports will be accurate and entire, proving satisfactory to your office in the highest degree.

I thank you for all assistance extended to me by yourself and your office force.

Respectfully submitted,

D. S. JONES.

Irrigation Engineer, Division No. 3.



## IRRIGATION DIVISION NO. 3.

TABULATION OF WATER COMMISSIONERS' REPORTS, 1905.

	Length of Main Ditch, Miles	Av. daily amt. of water during season, sec. ft.	Total No. of acres that can be irrigated	CROPS IRRIGAT'D FROM CAN'L IN ACRES					COST, DOLLARS		
				Alfalfa	Natural Grasses	Orchards	Other Crops	Peas for lamb feeding	Superintendence	Repairs	
District No. 20. ....	961	1,627	443,598	2,822	47,878	80	145,466	36,000	\$2,213	\$10,279	Commissioner very sick.
District No. 24. ....	216	240	37,560	3,250	13,880	.....	9,381	1,945	722	2,344	
District No. 22, no report	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
District No. 24. ....	34	97	11,077	0	1,301	.....	7,106	.....	775	565	Only first 19 priorities reported.
District No. 25, indefinite.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
District No. 26. ....	54	283	23,205	1,435	13,346	.....	1,362	.....	.....	.....	
District No. 27. ....	31	.....	4,725	210	2,025	10	340	.....	60	50	Commissioner not acting.
District No. 35, no report.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Total for div. as reported.	1,296	2,247	520,165	7,717	78,430	90	163,655	37,945	\$3,770	\$13,238	
Supplying estimates for districts not reporting the entire total for Division No. 3. ....	1,600	3,050	600,000	8,000	100,000	100	170,000	40,000	4,200	15,000	

D. S. JONES, Division Engineer.

## IRRIGATION DIVISION NO. 3.

Annual Report, 1906.

November 12, 1906.

Hon. T. W. Jaycox,

State Engineer, Denver, Colo.

Dear Sir—I have the honor to present to you my annual report for the irrigation season of 1906, together with the reports of the several water commissioners within this division.

The season has been unusual, in that all streams have flowed sufficient water for all irrigation purposes throughout the entire division, with the exception of those in one district in the extreme north end of the valley.

All streams reached the highest point on June 13, and remained at a high stage for several weeks.

Regular reports from all districts, save No. 35, show a successful season, and briefly summarized are as follows:

District No. 20—Comprising the Rio Grande and its immediate tributaries, a very large district, has been operated by Mr. Geo. C. Widman with but little assistance, having had but two deputies at any time, and then for a short time only. There has been full crops throughout the entire district. No litigation and but few disputes to settle.

District No. 21—Comprising the Alamosa and La Jara rivers, has had an excess of water during the entire season; the heavy rainfall has damaged the native hay crop and retarded the harvesting of small grains.

District No. 22—The Conejos river and its tributaries, was controlled by Mr. J. C. Dalton, who passed away late in the season. Mr. E. Coombs, his deputy, filled out his administration, going over the territory carefully, compiling crop reports, etc. At no time was the full flow of these streams in use for irrigation. I enclose his comments on the season's work with his commissioner report.

District No. 24—The water commissioner, Mr. J. P. Sanchez, was not called into the field until July 1. He had no trouble during the balance of the season.

District No. 25—Mr. Frank Cargo, the water commissioner here, has numerous small streams in his territory and the flow has not been sufficient to supply all when called for. He has been successful in distributing the amount available, however, so that crops have been good. Several disputes have arisen but they have been settled without litigation.

District No. 26—Comprising the Saguache and its tributaries has been ably handled by Mr. W. R. Donnell. There has been

no serious shortage here, but has taken careful distribution to make all crops good.

District No. 27—The La Garita and Carnero creeks, have supplied plenty of water for all and there has been but little trouble in its distribution.

District No. 35—Here the water commissioner has been in the field but little and he has failed to make any reports during the season, so that we have no figures on this territory.

The tabulation of all water commissioners' reports show as follows:

Number of sec. ft. of water appropriated in division.....	12,272	
Number of miles of ditches in division.....	1,274	
Average number of days water was used in division..	118	
Average daily amount of water used in division.....	3,665	
Number of acres of alfalfa in division.....	10,444	
Number of acres of natural grasses in division..	124,881	
Number of acres of cereals in division.....	118,460	
Number of acres of orchards in division.....	64	
Number of acres of gardens in division.....	189	
Number of acres of potatoes in division.....	7,390	
Number of acres of field-peas in division.....	145,813	
Total number acres irrigated in Division No. 3.....		408,441

The field pea now covers a larger area than any other single crop in the entire valley. These are pastured off by fattening stock, largely lambs, but cattle are being fed on them and the feeding of hogs, turned into them to fatten, either after the cattle or on the entire crop, has become an important industry.

The sub-irrigating area increased the past season to a greater extent than ever before, extending fully one mile along its western border through districts No. 20, 21 and 22.

Large areas, first settled in the lower parts of the valley, have become badly seeped and alkalied. It is hoped that the government will take steps to reclaim these lands and State aid given to bring them back to their original fertility.

The heaviest snow storm ever known fell October 20; this, with many rains during the fall, has saturated the soil throughout the entire division, and there can be no doubt of a successful season for the coming year.

The government has opened the lands on the Rio Grande drainage to reservoir filings and many prospective storage reservoirs are now under way. We look for an era of advancement in irrigation during the next few years that will far exceed the

progress made during a like period since the settlement of this vast valley.

I thank you, and your office force for the courtesies extended and assistance rendered me whenever called for, in the discharge of my duties.

Respectfully submitted,

D. S. JONES,  
Irrigation Engineer, Division No. 3.



## IRRIGATION DIVISION NO. 3.

TABULATION OF WATER COMMISSIONERS' REPORTS, 1906.

	Nos. of Priorities	Amt. of ap- propriation, sec. ft.	Length of Main Ditch, Miles	First day water used	Av. No. of days water carried from nat. stream	Av. Daily amt. of water dur- ing season, sec. ft.	CROPS IRRIGATED FROM CANALS IN ACRES							Total Irrigated
							Alfalfa	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Peas	
District No. 20. . . . .	365	3,260	432	3-1	190	1,800	3,427	47,725	64,398	15	32	5,553	138,786	249,931
District No. 21. . . . .	106	2,110	245	3-1	85	350	1,505	9,120	15,005	.....	67	758	4,545	31,000
District No. 22. . . . .	144	4,588	312	3-20	160	1,000	3,420	25,822	30,590	.....	.....	690	12,482	73,004
District No. 24. . . . .	64	355	50	3-25	175	325	465	10,277	5,537	31	82	263	.....	16,655
District No. 25. . . . .	135	1,008	135	3-22	70	85	304	14,615	1,210	.....	.....	51	.....	16,180
District No. 26. . . . .	132	594	75	3-1	72	75	2,106	16,747	1,208	12	6	37	.....	20,116
District No. 27. . . . .	51	47	25	4-1	75	30	217	775	517	6	2	38	.....	1,555
District No. 35. . . . .	46	310	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total Irr. Div. No. 3. . . .	1,043	12,272	1,274	.....	118	3,665	10,444	124,881	118,460	64	189	7,390	145,813	408,441

## IRRIGATION DIVISION NO. 4.

Annual Report, 1905.

Grand Junction, Colorado, November 21, 1905.

To the Hon. T. W. Jaycox, State Engineer, Colorado.

Dear Sir—In submitting this report for the season of 1905, I find myself, as on former occasions, confronted by a difficulty when I attempt to comply with the provisions of the act. I presume that the main feature of the division engineer's report should be the tabulation of the reports of the commissioners in his division, and I can readily understand that the study and tabulation of these might lead to a report that would be of much interest and considerable value as a record. But the fact that only about half of the reports are in, and that it seems to be impossible to tabulate those that have been received in any satisfactory manner, makes it impossible for me to do much more than submit them herewith as a part of the report, and to defer all further reference to them until the annual meeting.

I had hoped at this meeting to present a copy of the drainage register, which I have been preparing during the year, but I am unable to do this as it is still in an incomplete state. I am still waiting for the court to issue several decrees, and it is impossible to list the rights on the various streams according to date in the division until they are received, as it would be necessary to revise it before next season's work begins.

## WATER SUPPLY AND CROP CONDITIONS.

Generally it may be said that the supply of water throughout division No. 4 has been ample to raise and mature all crops put in. The flood water of the main drainage of the Gunnison and such part of the Grand as came under my observation was above the average, and the Grand below the mouth of the Gunnison was probably higher than it has ever been known to be. The Gunnison itself contributed very largely to this condition, and although some of its tributaries have been higher even in recent years, it is doubtful if the discharge of the river itself has been greater. Unfortunately the gauge stake established by the government near the mouth is only of value as a gauge of height, and no estimate that can be relied upon of the discharge can be made.

The same conditions existed south of the San Juan mountains, the Dolores and tributaries of the San Juan were very high, notably the Animas.

Later in the season the supply was fairly well maintained, though there was very little rain generally, and the season must be classed as a particularly good one. Although in some districts commissioners have been kept busy during the late summer and

fall, and certain ditches could not be supplied with water, there has been no report of burnt up crops and about everything planted matured. Such reports as I have received as to the reservoirs on the Grand mesa are not in such shape that I can give figures to show to what extent stored water has been used to supplement the natural flow, but generally it appears that most of the stored water has been used.

#### NEW IRRIGATION ENTERPRISES.

Apart from projected ditches and reservoirs, of which you have approved plans during the year, there are two or three important undertakings which may be briefly referred to.

The progress of the government work in the Uncompahgre valley seems to be satisfactory, construction being now carried on as to the main tunnel by the government, and as to the laterals by private firms under contract. I am unable to give an authoritative statement as to what arrangement will be made as to the use and ownership of the old water rights and ditches, whether they will be disposed of to the Water Users Association or still remain independent. The residents of the valley generally seem much pleased with the prospect before them of an increased water supply and irrigated area in the valley, but the ignorance prevailing as to the scheme of distribution, and the eventual standing of old water rights and the disposition of old ditches is astonishing. Some dissatisfaction is being expressed as to the construction of expensive new ditches on the grounds that the old ones would suffice, but the undertaking is so large and complicated that I do not feel that any criticism on my part would have any value without much more information as to the plans and intentions of those in charge.

The Grand Valley Irrigation District, formed under the State law, is still in existence. The surveys have been completed, but nothing is being done until the decision of our Supreme Court is given in the case of Anderson vs. the Grand Valley Irrigation District, a suit brought to test the constitutionality of the law.

The Palisade Irrigation District is fully organized and in running order. The district acquired the old High Line Mutual ditch and built extensions and a new ditch. The district including about 6,000 acres covers some of the most valuable land on the western slope. The bonds were placed for 95 per cent. of the par value.

Efforts are still being made by residents in the Grand valley to induce the reclamation officials to take up the proposed high line ditch from the Grand river. The sufficient amount of acreage has been subscribed by owners; the government asked that at least 90 per cent. of the land expected to be embraced in the area irrigated by the canal should be subscribed, and more than 93

per cent. of this has come in. The lack of funds for a new project in Colorado seems to be the only obstacle to this undertaking.

#### OFFICIAL FACTS—A RATING.

In consequence of the good supply of water in the early part of the year, and the fact that few commissioners were at work early, there has been very little demand for rating, and from the districts on the San Juan drainage there has been none whatever and practically no reports. Such ratings as have been made were only intended for temporary use, the condition of the ditches rated being such that no permanent rating could be given. Although the year would theoretically appear to have been a good one for general rating, the flow of water having been sufficient to supply almost any ditch with the sufficient amount of water, as a matter of fact there was little demand on the division engineer for this service. It is noticeable that very few owners seem to desire rating, and if the commissioner is not on duty it seems inadvisable to call him out unless he should have some very good reason to require a rating for any particular ditch in preparation for the time when his services will be required. Nor is it advisable in the newer districts at least to in any way lengthen the term of the commissioner's services over the time actually given to distribution, any additional expense being objected to generally by the boards of commissioners in the various counties.

Although some ratings are preserved for a record of the facts and conditions existing at the time, none are sent in herewith, as they have no permanent value as ratings for the ditch.

#### HEADGATES AND FLUMES.

The question of headgates and flumes is an important one. The intent of the law of 1901 was evidently to provide an almost immediate remedy for refusal or neglect in this matter. But in practice it does not work out very well. In at least two districts the commissioners saw trouble impending on account of very general need of proper headgates and flumes, and being new officers they could not tell in which cases it might be necessary to take immediate action, and in which the want of gate or flume might not be a matter of importance. They desired, and I authorized, an investigation to obtain the necessary facts, so that notices might be generally served. As it happened that one commissioner was not called out, and the other's services were only required on certain small creeks in his district, nothing was done, except that most consumers were notified and advised to put the necessary gates and flumes in order, and warned that in case of failure to provide them they might at some future date expect a notice at a possibly inconvenient time. I believe that if the law were so amended that the mythical superintendent of irrigation were cut out and his power given to the division engineer, these notices could in the majority of cases be so served that very



few would fail to comply with them. And it would be certain that those offenders whose neglect was a source of annoyance to the commissioner and other consumers would be reached.

The enforcement of this law is very generally demanded. At the same time a general compliance can hardly be enforced, and in certain cases the enforcement of it would seem to be unnecessary. A number of ditches in the hills are high water ditches and are practically never measured. Other ditches on creeks in the hills are also high water ditches and in some cases do not require gates except to protect themselves from flood, and in others do not want gates which would enable the commissioner to shut them down. Except by making demand on these high water ditch owners in the early spring, there is practically no way of enforcing the penalty. The most annoying class is the one that constructs a ditch without a headgate through which he can divert water from reservoirs while it is passing through the public streams. I have authorized a commissioner to fill such ditches with dirt as being the cheapest method, and to treat the fill as a gate, enforcing the penalty in case of interference.

#### LOANS.

The decision in the case of The Fort Lyon Canal Co. vs. Chew has practically done away with the demand for loans in this division. The old practice of indiscriminate loaning has been stopped and I have not heard of a single demand for a loan for the sake of rotating water. Two loans have been brought to my attention, both of the kind as to which the Supreme Court does not give us a definite ruling, where the water had not done duty in any other ditch during the season, and the owner wished to change it temporarily for the purpose of saving crops to a ditch to which it had not been decreed, the actual change having no injurious effect on other consumers. These I allowed, and I hoped that the objection raised in one case would result in an appeal to you.

#### PAYMENT OF COMMISSIONERS AND DEPUTIES.

This very important question is continually coming up, and I give the following instances:

a. Nothing has yet been determined as to the counties from which the commissioner of district No. 62 shall collect his pay. The fact is that the Cimarron is drawn upon by a feeder ditch that conducts water over a divide to other streams and thence is used on lands in Ouray and Delta counties, being delivered to the consumers by other commissioners. Are these counties liable? Personally I think that they are. Last year Delta county consumers made the first call on the commissioner. The counties deny liability.

b. The county commissioners for Delta and Montrose counties are this year for the first time realizing that Gunnison county is liable for one-third of the pay of the commissioner of district No. 40. There has been no adjudication of any rights in Gunnison county in district No. 40, and the commissioner has not rendered any services in that county, but under the decision of the Court of Appeals, in *Chew vs. Fremont County*, the commissioner of the district will probably be asked to collect from the three counties instead of from two as in the past. He may have to bring suit.

c. The question as to which counties should pay for the commissioner and deputies of No. 68 is also unsettled. District 68 consists of lands taking water from the Uncompahgre river and tributaries above district 41. It frequently becomes necessary to call upon the commissioner and his deputies in 68 to go on duty, not to benefit the county of Ouray, but to close down ditches in favor of prior rights belonging to ditches which water lands in Montrose and Delta. The question to be determined is whether the latter counties should pay for the services rendered. Under the statute one would think not, and no ruling seems to have covered the point. At present there is an agreement as to pay.

The doubt as to the payment of bills for services rendered is a continual source of annoyance to commissioners and their deputies. It appears to me that when the statutory description of districts, and the decisions as to pay are carefully considered by anyone who is acquainted with the practical workings of irrigation it will be noted that a decision as to the liability of individual counties may at any time be upset by the construction or abandonment of a particular ditch, or in other words, by the enlargement or restriction of the irrigated area. The Supreme Court (*Lamson vs. Vaile*, 27 Colo., 201), has said that "the distinction that the point of diversion of the ditch is the sole factor determining the jurisdiction of the court is not good," and the same point can well be understood as applying to the boundaries of a district. This state of affairs leads to the possibility of continual dissatisfaction and litigation as the canal and reservoir system is extended, and the decision that counties should pay equally, the rate not being dependent upon the value of the service rendered leads to a further feeling of dissatisfaction. The remedy seems to be the payment of all water officials by the State.

### LITIGATION.

a. Changes of point of diversion.—Two important cases have been recently decided by the district court.

In district 41 changes on the Uncompahgre river from the points near the mouth of priorities two and three to a point about thirty miles further up have been denied. These changes

were begun in 1896, and were sanctioned by the water officials. After the passage of the act of 1899 a change of 62.8 inches was allowed by the court, no recognition being given to previous changes. In 1903 the officials drew attention to the fact that they had no court sanction for any of the changes but one, and after some discussion the question as to whether those who had made changes prior to the act of 1899 had to get the sanction of the court was squarely raised on demurrer in a suit brought against the irrigation officials. The court ruled that no injunction could be granted against officials who were following the decree, and appointed a referee to take evidence as to the effect of these changes and of similar new ones that were to be asked. An appeal was taken to the Supreme Court, and as a result of the view held by that body the judge of the lower court granted the injunction previously denied. As an immediate result the owners of 451.47 inches previously changed retired from the petition before the referee, who then proceeded to take testimony as to the change of 173 inches. The referee found the change would be injurious and the judge has adopted his findings. The manner of injury is shown in two ways, deterioration of the quality of the water in the stream by decreasing the natural flow which would pass down the river, and necessarily greater demand on the natural flow, it being shown that at the original point, inflow and seepage largely supplied the rights.

A different state of affairs was shown on Minnesota creek in district 40. A petition to change the point of diversion from the original point near the mouth of the creek to one about five miles further up of some early priorities was pending at a time when under some kind of an agreement the commissioner made a temporary change. This was objected to later and the division engineer ordered it stopped, and was immediately requested to sanction a loan. Objection on various grounds was shown, but no injury appearing, and it being admitted that the water had not done duty at any other point during the season, and the main objection on grounds of abandonment and non-user being ones that the officials could not rule upon or consider, the loan was allowed. In considering the matter, although the question of injury was most thoroughly gone into, and the need was also sufficiently proved, it did not seem clear that a commissioner had really any discretion in the matter of a loan, or that a superior officer had a right of review. In the case on petition the evidence seems to have convinced the judge that there was no injury caused by the actual change. The inflow appeared to be very small, and the loss by absorption from the upper point down to the original point of diversion appeared to be considerable, and measurements made by the division engineer and others sufficiently prove this fact. But there appears to have been shown some probability of necessarily enlarged use at the new point of diversion, or of possible abandonment at



the original point of a part of the decree, and the court, while allowing the change of about half the amount asked, refused it as to the balance.

Apart from the interesting legal points raised the cases are interesting as showing the different effects of upstream changes depending on the amount of inflow and seepage on the one hand and the percentage of loss by absorption on the other, and the consequent net result of loss or gain caused to the supply in the stream by the change.

b. Procedure prior to litigation.

In two cases—First in Montrose county where the Loutsenhizer Canal Co. sought an injunction to restrain the commissioner from allowing domestic water in irrigation ditches in violation of decreed irrigation rights, and Second in Mesa county, where the owners of a junior right on a tributary sought to restrain the commissioner from shutting off their supply to satisfy the need of a prior right on the main stream, the court held that before bringing suit and invoking the equity powers of the court applicants must proceed through the statutory remedy and appeal to the division engineer and state engineer for redress. In each case the suit was dismissed, in the first case a demurrer being sustained on the above grounds, and in the second by stipulation. In the first case the division engineer and state engineer had been made parties, though no appeal had ever been made to them, and in the second they were not made parties, though appeal had been made to the former, who had sustained the commissioner. The ruling of Judge Stevens should do much to stop such unnecessary and annoying litigation, and there should be little doubt that it will be affirmed should appeal be taken on the point to the higher court.

c. Ambiguous decrees.

Such decrees are the only good excuse for the flood of litigation that seems so ready to overwhelm some districts, and the lack of strict administration according to the decree seems to be the chief reason for its not having come sooner. The separate numbering of rights on tributaries is being kept up in an adjudication pending in district No. 42, but the referee has consented to put in a proviso that such numbering shall not determine the relation of rights on different streams, this being determined by the date of appropriation solely. This it is to be hoped will make the decree clearer to the parties.

The conditional decrees of district 40 are leading to a great deal of litigation, and I am afraid much more will follow, before the rights are fully understood. As an instance the Smith's Fork decree may be noted, the first adjudication being in the general decree of 1889. Several attempts to adjudicate further were made during the period from 1893 to 1900 but not until 1903 was a new decree obtained. In this the doctrine of rela-



tion was upheld and the court reaffirmed the rights granted absolutely in the former decree and gave additional amounts to the old ditches dating the date of appropriation back to the original date where due diligence had been shown. Then reargument and in 1905 a new decree vacating that of 1903, and putting all rights granted thereunder in a separate list, all being junior to those absolutely granted in 1889, on the grounds that, though due diligence had been shown in appropriation, application to the court should have been made within four years. Then the case of *Waterman vs. Hughes* from the Supreme Court, and then further reargument of the 1905 decree at the last term of court, which decree, however, still stands, and appeal has been taken to the Supreme Court. The rights on other creeks are based in many instances on the same original conditional decree, and the various methods of interpreting it in the past adopted by commissioners, coupled with the many changes in point of diversion allowed by the same officials, must culminate in litigation when each right is strictly interpreted.

#### MISDEMEANORS AND SUITS AGAINST COMMISSIONERS.

The law has been strictly enforced along the line of the Uncompahgre river and incidentally several arrests have been made. In district 68 the commissioner has not reported any trouble in distributing water according to the decrees of his and the adjoining district, under the orders of the division engineer, but in district 41 it was found necessary to make three arrests. In one case a plea of guilty was followed by a fine. In another the offense was openly committed, the jurisdiction of the commissioner being disputed, but at the subsequent trial the jurisdiction of the court was attacked on the grounds that the headgate was situate in Ouray county. The court, however, maintained jurisdiction and a fine of \$100 and costs was imposed. Appeal was taken on the question of jurisdiction. In a third case the justice of the peace seems to have taken the case from the jury and dismissed it for want of evidence, an action which seems to have surprised attorneys.

On the other hand a suit is pending against the commissioner of district 41 for neglect of duty and damages in the sum of \$10,000, and one against his deputy for damages in the sum of \$500, for tearing out a dam.

#### DEVELOPED WATER.

In district 41 the first application made in the division for an adjudication of water claimed to have been developed is pending. The case is made practically under the irrigation acts, and is asked for in district 41, though the essence of the claim would appear to be that it is not tributary to the Uncompahgre

river. In the claim it would appear that certain marshy and swampy land, rendered so by springs, has been drained by an open ditch, and the water which had been previously prevented from escaping by an impervious dyke has been released. There are other claimants of developed water in this district, and it is expected that most will apply to have their rights adjudicated, as the commissioner seems to have warned them that he will not recognize them without court sanction in the future. The public generally is demanding that these claims should be investigated. In most cases the water claimed is turned into the river and rediverted by the owners, and thus directly comes into the charge of the commissioner.

### SUGGESTIONS.

Basing my suggestions mainly on the experience of the past year, and referring to the foregoing for some of my reasons for them, I append the following:

1. State control of all branches of the irrigation service, as to appointment, qualification and remuneration.
2. Absolute enforcement of the law, the strictest interpretation of decrees, and fuller subordination of officers to their superiors.
3. A more uniform and clearer form of decree for the future.
4. A uniform and more exact system of measurement, and more accurate system of recording measurements.

It may be worth mentioning that I have prepared an abstract of all statutes relating to irrigation and kindred subjects, and of all Supreme Court rulings along those lines, which I have found of great value, and has, I believe, been a help to commissioners.

My relations with all commissioners have been very pleasant, and I hope mutually helpful.

With many thanks for your kindness and assistance during the season, I am,

Yours very respectfully,

ARTHUR H. STOKES,  
Irrigation Div. Eng., Div. No. 4.



Showing Method of Riprapping Outlet Channel, Cache La Poudre Reservoir,  
Water District No. 3.



Concrete Diversion Dam and Head Gates, Larimer County Ditch, Cache La  
Poudre River.





## SUMMARY OF COMMISSIONERS' REPORTS FOR SEASON OF 1905.

District No. 28—Commissioner was not called out for service. Commissioner was ordered by division engineer to report on the condition of gates and flumes which he had mentioned as being in such condition that he would not be able to distribute water when called upon. He made an investigation of all ditches and consumed 12 days in the work with report. Cost of services, \$60.00.

District No. 29—Commissioner did not work for any purpose.

District No. 30—Commissioner did not work for any purpose. Reports that he was notified by the board of county commissioners that he was ineligible.

District No. 31—No commissioner.

District No. 32—No commissioner.

District No. 33—La Plata river. Supply here is limited.

Total amount of water decreed.....	85.18 ft. per sec.
Amount reported upon.....	68.10 ft. per sec.
Total used in acre feet.....	11,866 acre ft.
Total acreage of crop.....	1,918 acres.
Acre feet per acre.....	6.18 acre ft.
ITEMIZED CROP REPORT:	
Alfalfa.....	522 acres.
Grass.....	310 acres.
Orchard.....	2 acres.
Cereals.....	1,017 acres.
Potatoes.....	60 acres.
Other crops.....	7 acres.
Commissioner's time, June 2 to Aug. 31, 91 days.....	\$ 455.00

Two ditches reported upon show the use of water to have been 7.4 and 19.2 acre feet per acre. No deputies were employed.

District No. 34—Dolores river. Crop report on 19 ditches out of 21, with decrees:

Amount decreed, absolutely.....	29.3 ft.
Amount decreed, conditionally.....	23.3 ft.
Total acreage.....	1,329 acres.
Acres to each ft. decreed, (abs.).....	45 acres.
Acres to each ft., duty under decree.....	50 acres.
ITEMIZED CROP REPORT:	
Alfalfa.....	515 acres.
Grass.....	289 acres.
Orchard.....	6 acres.
Cereals.....	451 acres.
Potatoes.....	68 acres.

Mancos river—Crop report on 23 ditches out of 34, with decrees:

Amount decreed.....	149.4 ft.
Total acreage.....	4,192 acres.
Acres to each ft. decreed.....	28 acres.
Acres to each ft. under decree.....	50 acres.
ITEMIZED CROP REPORT:	
Alfalfa.....	2,500 acres.
Grass.....	378 acres.
Orchard.....	65 acres.
Cereals.....	1,114 acres.
Potatoes.....	135 acres.
Commissioner's time from July 15, 55 days.....	\$275.00

No data are given from which use of water can be estimated in acre feet. No report is given for the Montezuma Valley, but one may come later.

District No. 40—I find it impossible to make any satisfactory tabulation from this report. Several field books are sent with the report, but many of the data are contradictory. There has been an evident attempt to get the information desired, but want of system and knowledge as to how to make entries is apparent. The crop reports, when I attempt to classify them for particular creeks, are contradictory, and the fact that it is not clear how much reservoir water was used by each ditch, makes it impossible to treat this report as I have some others. As an instance, take: Carbon ditch, use of water 48 days, average 1.3 ft., crop 75 acres, and hence 124.8 acre ft.

used or rate of 1.66 to acre, reported by Deputy Ritter; and: Carbon ditch, use of water 200 days, average .5 ft., crop 27 acres, and hence 200 acre ft. used or rate of 7.4 per acre, reported by Deputy Berkly; and: Shepherd ditch, acreage given as 240 acres by Deputy Richardson and as 500 acres by Deputy Berkley.

Time of Commissioner, from Apr. 28 to Nov. 16, 201 days	\$1,005 00
14 deputies put in 945 days	2,362 50

### District No. 41:

Amount decreed to ditches reported.....	1,066.04 ft.
Amount decreed to ditches unreported.....	502.26 ft.
Total acreage reported .....	28,499 acres.
Acres to each ft. decreed.....	26.7 acres.
ITEMIZED CROP REPORT:	
Alfalfa.....	13,848 acres.
Grass.....	405 acres.
Orchard.....	2,065 acres.
Cereals.....	10,375 acres.
Beets.....	658 acres.
Potatoes.....	802 acres.
Other crops.....	346 acres.
Commissioner's time, from Apr. 24 to Nov. 30, 160 days.....	\$800.00
Six deputies put in 755.4 days.....	\$1,888.50
One deputy put in 79 days at 50 cts.....	39.50

No data as to time of use of water. It seems impossible to get at present returns as to crops from the large Montrose canal, but I may get this later, and send it in.

District No. 42—This report is not of such a nature that I can make a satisfactory tabulation either as to crops, which are only given for a few creeks, or as to use of water. I am trying to arrange for a report of crops from the Grand Valley canal and the Palisade irrigation district, by far the greater part of the district, but one where the commissioner's services are never needed. The absence of anything like full data as to use of reservoir water makes it unsatisfactory to attempt to estimate the duty of water.

Commissioner's time, 105 days.....	\$525.00
Five deputies put in 273 days.....	682.50

## District No. 60—Beaver creek. Supply limited.

Amount decreed, to one ditch, and reported on.....	50	ft.
Acreage reported, mostly alfalfa.....	2,825	acres.
Acre feet used.....	6,000	ac. ft.
Acre ft. per acre.....	2.12	

## San Miguel—Supply unlimited; only 40 stat. in. decreed.

Acreage reported, mostly cereals.....	1,095	acres.
Acre ft. used.....	3,940	ac. ft.
Acre ft. per acre.....	3.6	

## Maverick draw—Supply limited and fluctuating.

Total decreed to eight ditches.....	5.5	ft.
Acreage reported from seven ditches, alfalfa.....	236	acres.
Acre ft. used.....	716.66	
Acre ft. to acre.....	3.03	

## Naturita—Supply varying.

Twelve ditches decreed.....	18.39	ft.
One ditch reported with decreed water.....	9.84	ft.
Acreage, mostly alfalfa.....	810	acres.
Acre ft. used.....	1,500	
Acre ft. per acre.....	1.85	

The above are separately tabulated, as the systems are independent and conditions vary under each.

Total acreage.....	4,951	acres.
ITEMIZED:		
Alfalfa.....	3,455	acres.
Grass.....	60	acres.
Cereals.....	1,359	acres.
Orchard.....	16	acres.
Other crops.....	61	acres.
Commissioner's time, from May 29 to Oct. 19, 34.5 days.....	\$172.50	



District No. 61—No report, or reply to recent letters.

District No. 62:

Ninety-seven ditches decreed.....	275.42 ft.
Seventy-eight reported, decreed.....	185.57 ft.
Total acreage.....	6,573 acres.
To each foot decreed.....	35.4 acres.
Duty to each foot under decree....	38.4 acres.
ITEMIZED ACREAGE:	
Grass.....	5,289 acres.
Alfalfa.....	493 acres.
Cereals.....	752 acres.
Other crops.....	39 acres.
Commissioner's time, 71 days up to Oct. 3.....	\$355.00

Commissioner reports no water used after October 3, and only 3 rating flumes, put in by himself, in district. No report as to amount or time of water used sent in.

District No. 68:

One hundred and twenty ditches decreed.....	573.5 ft.
Ninety-two ditches reported, with decreed water.....	481.87 ft.
Total crop reported.....	13,562.5 acres.
Acre feet used.....	43,236
Acre feet per acre.....	3.18
Acres to each decreed foot.....	28.02 acres.
ITEMIZED CROP:	
Alfalfa.....	54,00 acres.
Grass.....	4,385 acres.
Orchard.....	97 acres.
Cereals.....	3,282 acres.
Garden.....	79 acres.
Beets.....	2 acres.
Potatoes.....	317.5 acres.
Commissioner's time, from May 30 on, 88 days.....	\$400.00
Four deputies put in 314 days.....	785.00

No attempt is made to return a total acreage of crop for division No. 4 from the above, as a very large proportion of the irrigated land is not reported on by commissioners. There are some isolated parts to which commissioners are not called, and it has not been the custom generally in the division for commissioners to visit them, or to put in time specially to ob-

tain data for a crop report. This, of course, can be insisted on another year if you should order it. It should also be recognized that to obtain accurate returns from some of the large ditches is most difficult, and in consultation with the manager, superintendent and ditch riders of the Grand Valley canal, as an instance, I find that they are quite unable to give me a report which would be even fairly accurate, though as a basis for other years we are going to get together and frame one for correction as errors are discovered. The same difficulty is reported from the Montezuma canal and the Montrose canal, these being the next canals in point of size in the division.

To make anything like an accurate return of the amount of water used it will be necessary to drill all deputies into a systematic and accurate method of keeping their field books. This can be done, but it will take the strict co-operation of the commissioners, and careful choice of deputies. It will, to have value, also need an accurate system of measurement and accurate men to measure. This we have not got.

In order to have anything like a complete report it will be necessary to have the co-operation of all ditch owners, who must be relied upon to furnish the commissioner with accurate reports for the time that they are not working. To get this will be most difficult, chiefly on account of the unwillingness generally manifested by consumers to go to any trouble for what they think is at best an unnecessary report.

I have scrutinized all reports with great care and submit the above as the best that I can do with them, my object having been in each case to subtract from each such facts as may be of value as a record. The reports themselves may be accepted for what they are worth to show such other facts, and give such other information, as does not appear in my summary.

Very respectfully,

ARTHUR H. STOKES,  
Irrigation Div. Eng., Div. 4.

Grand Junction, Colo., January 8, 1906.

The Hon. T. W. Jaycox, State Engineer, Denver, Colo.

Dear Sir: I sent to your office under separate cover the reports of commissioners for 1905, and also the reports of district 42 for the years 1903 and 1904, which you sent to me.

I enclose herewith a summary of the commissioners' reports for the year 1905.

As I stated in my annual report to you, I can well understand that a tabulation of these reports would have much value, showing the total use of water, the duty of water and the flow of the various streams, etc., but for various reasons

these reports do not furnish enough data for me to work on. I allude to this in my report.

In your letter of the 3rd you refer to Mr. Hider's claim against Gunnison county. About a year ago the county attorney of Delta county, after a meeting at Montrose referring to the pay of commissioners, drew my attention to the fact that there were ditches on the North Fork watering lands in Gunnison and asked me to write him my opinion as to the liability of Gunnison for a proportion of the commissioner's pay. I wrote him as you have written to Mr. Hider. The Montrose commissioners, acting on my advice, I believe, refused to pay more than one-third of his bill, claiming that Gunnison was liable with Delta and Montrose. For this reason the bill went to Gunnison this year, though it has always previously been divided between Montrose and Delta. I may mention that no commissioner has ever been into Gunnison county to regulate the ditches there for reason which he can best explain, I suppose, because the North Fork always had plenty of water.

I will write Mr. Cundiff asking him to make a further statement as to the standing of the county commissioners down there.

The whole question of commissioners' pay is considered in my annual reports for the last two years. There has been a good deal of difficulty as to the pay of the commissioner of district 62.

Yours respectfully,

ARTHUR H. STOKES,  
Irrigation Div. Eng., Div. No. 4.

#### IRRIGATION DIVISION NO. 4.

Annual Report, 1906.

Grand Junction, Colo., November 30, 1906.

To the Hon. T. W. Jaycox,

State Engineer, Denver, Colorado.

Dear Sir: In presenting this report for the year 1906 I very much regret that for various reasons it does not give nearly such a satisfactory summary of the conditions in division No. 4 as I had hoped to present. Some of the more important reports are only just to hand, and it is too late to make any attempt to revise them, or have the commissioners do so. Some are also incomplete, returns as to crops and the use of water only being made for certain portions of the districts. These can not be tabulated, and no summary would have any value, and they must stand as they are, providing such information as they may. I give a list of the districts with such notes, and facts

gathered from the reports that have been received, as will serve to show the condition in each.

### DISTRICT NOTES.

It will be noted from the above that the only returns from the whole San Juan drainage are those from the La Plata river, and from the Mancos. It will also be seen that with the exception of the returns from districts 60 and 61, West Paradox and the San Miguel, there is nothing of value from the Dolores drainage. It will also be seen that with the exception of the attempted crop returns from district 28 there are no returns from the whole Gunnison drainage above the line of Delta county, and even in that county there is no return from the ditches taking water directly from the Gunnison. The lower half of the Uncompahgre river is covered by the report from district 41, the upper half is included in district 68, and up to date there is no report. The only reports covering the Grand river drainage are contained in the report from district 42, and only the Plateau valley and Kannah creek is covered.

From these statements it will be seen that a report fairly representing division No. 4, either as to crops or the use of water, such as you desired, is out of the question. No representative report ever has been submitted, and the most that can be hoped for under existing conditions is to get accurate returns covering such parts of a district as the commissioner visits, and an absolutely accurate statement, either by the week, month or year, of the amount of water which each commissioner and every one of his deputies distributes. The reasons for the lack of information are not hard to seek.

1st. Even in some adjudicated districts it has been unnecessary to call out the commissioner, and some districts are still unadjudicated.

2nd. Some commissioners are employed simply in an emergency and never visit a great part of their districts.

3rd. No commissioner is employed for the whole irrigating season and finds it impossible to collect by enquiry the information which he is asked to give in his report. And further as to crop reports—any extension of service in order to obtain these is not countenanced generally by the boards of county commissioners who are the paymasters. The latter in fact seem to hesitate to pay the bills presented for the actual distribution of water. These facts are so far recognized that I find them stated in a recent bulletin of the department of agriculture, No. 168, page 15.

4th. It seems difficult for some commissioners to secure deputies who can clearly and intelligently keep a record of what duties they actually perform, and present them in a field book. This difficulty can be overcome.



It may be said that generally the supply of water in division No. 4 has been plentiful, and more water was stored than was needed for use during what is usually the dry season. Although this fact has prevented any particular difficulty in the distribution of water, it has to some extent accentuated the objection made by some boards of county commissioners to the payment of salaries to commissioners and their deputies.

I anticipate discussion at our annual meeting as to the whole question of reports, and I would here merely suggest that serious attention should be given to the following questions.

1st. The duties of commissioners as to reports.

2nd. The construction and maintenance of headgates, and measuring devices.

3rd. The pay of commissioners and their deputies.

As to the first question—I would suggest that if it be a statutory duty of the commissioners to provide the data asked for in the law of 1903 he should know it, and after putting in sufficient time to obtain it should in some way be secured as to the pay for the same. My personal opinion is that the information demanded is not of sufficient value to warrant the great expense that its collection would involve.

As to the second I would give the opinion that the law of 1901 does not reach the worst offenders; when it comes to the enforcement of the penalty in the case of many there is no penalty. I believe that a far more drastic law might be passed without working any hardship on the owners of such valuable property as water rights now are. Why should there be a ten days' notice? Why should not the very passage of the law be notice enough.

As to the third—It may be accepted as a fact that the present interpretation of the law and the burden it places on some counties is most unpopular and unfair in division No. 4. I believe that the commissioners should be qualified as state officers and paid by the state. I further believe that they should be in fact far more directly under the control of the division engineers, who should be in a position to directly supervise their employment and time of service.

There is very little for me to report as to my own work. The unusual supply of water has made it easy to distribute, and there has been very little demand for rating. Some work in this line, the seepage investigation on the Uncompahgre river, (report of which is appended), and some investigation of the flow of water in Kannah and Whitewater creeks, comprise the actual field work. There has been no new litigation in the division to which I was made a party, and it is satisfactory to note that the irrigation officials have been sustained in the case of Ashenfelter et al. vs. Carpenter et al.

The most important question that has been submitted to me for temporary settlement is one that involves the commissioner's action as to water turned into a stream in his district from a source which he can not control. This includes seepage and waste waters and so-called developed waters. To cover cases in which a commissioner had refused to allow such waters to be rediverted until the right had been decreed, I issued the order given below. It is based on the view that such waters as come within its scope are prima facie not tributary, and are not until turned into his stream, with the intention of rediverting, subject to his authority either actually or legally.

Order.

When, after a full performance of your duties as a guard of the public streams in your district, and the prevention of all waste of water by ditches supplied from the streams furnishing water to your district, you shall find ditches turning water, from sources which you can not control, into the public stream, you shall allow the owners thereof to take out the same amount again, less a reasonable amount for evaporation and seepage, provided the necessary measuring devices are maintained. Provided, that nothing in the above shall be taken to apply to tail ditches or ditches taking water from a source which has been decreed to be tributary to the streams of your district.

This in the absence of any decree as to the rights of the ditches concerned.

As to the development of irrigation work in the division I have to report the completion of the pumping station and canal at Palisade for the Mesa County Irrigation District. The pumps have a capacity of 31 feet per second, and are intended to supply water for 2,600 acres, almost all of which will be put into orchard. The Gunnison tunnel and canals are progressing satisfactorily in Montrose County under the officials of the Reclamation service. In other districts there is not much in this line to report, except that plans have been arranged and work started to appropriate practically all the surplus water from the San Miguel and other streams in district 60, and a sufficiently large canal, for power and irrigation, is under construction in Mesa county to take the water of the Gunnison river which will reach that county.

Respectfully submitted,

ARTHUR H. STOKES,

Irrigation Division Engineer, Division No. 4.

Below I give an abstract of the reports received from the commissioners of the different districts:

District No. 28—J. R. Hicks, Jr., commissioner, Tomichi and tributaries. An abundance of water and very good crops. Some

damage from wet during the haying season. The commissioner was called out to Razor creek, July 30, and found a shortage of water. The time put in by the commissioner amounted to 15 days, distributing water and making crop report. Expense, \$75.00.

The commissioner gives no opinion as to the measurement of water, but states that there are only three measuring flumes in the district. He says further that the owners kept no dates as to the use of water and he cannot give the information asked for in the blanks. He adds "I could not get authority as to the time I should take to make out the report, or whether I should make any report at all, etc."

The statistics furnished simply give the acreage in crop determined chiefly from the decree. The total acreage thus given is as follows:

Natural grass.....	21,043	acres.	
Gardens.....	9.5	acres.	
Potatoes.....	12	acres.	
Barley.....	83	acres.	
Oats.....	100	acres.	
Total.....			21,147.5 acres.

District No. 29—R. H. Bostwick, commissioner. San Juan River. The commissioner has not been employed, and has sent no report.

District No. 30—John Cundiff, commissioner. Rio Las Animas and tributaries. The commissioner has not been employed and has sent no report. Reports by letter an abundance of water.

District No. 33—John Cunningham, commissioner. La Plata River. The commissioner reports that he has worked for two years and has not received a cent of salary, and suggests that there should be some legislation to secure a commissioner his pay. He reports that he finds the open flume for measurement a slow process necessitating some knowledge of hydraulics, and suggests an automatic box or weir.

The time put in by the commissioner amounts to 106 days, with no deputies. Expense, \$530.00.

Alfalfa.....	1,315	acres.	
Grass.....	480	acres.	
Cereals.....	2,942	acres.	
Orchards.....	6	acres.	
Other crops..	117	acres.	
Total.....			4,860 acres.

Report shows a use of 4.34 acre ft. per acre.

No reservoir water was used.

District No. 34—H. M. Barber, commissioner. Mancos and Dolores Rivers. Commissioner reports so much rain that some ditches used little water. He suggests that commissioners should have power to distribute water under ditches; that commissioners should draw pay in some manner while waiting to be called out; that the construction and maintenance of measuring flumes and headgates should be adopted by the state engineer. He reports very few gates or flumes in good condition in the district, and believes that float measurements are accurate enough when flumes are in repair.

The commissioner put in 17.5 days distributing water (on the Mancos), and 11.5 days gathering crop report. Expense, \$145.00.

Alfalfa.....	2,659.5 acres.	
Timothy.....	539.5 acres.	
Grass.....	234 acres.	
Cereals.....	2,584.5 acres.	
Orchard ..	113.5 acres.	
Other crops..	159.5 acres.	
Total.....		6,290.5 acres.

Report shows a use of 2.22 acre feet per acre.

No reservoir water was used.

District No. 40—Geo. Hider, commissioner. Gunnison and tributaries, Delta county. The commissioner sends in a partial crop report, and for some creeks and streams gives some information as to the use of water. He states that his field books give very little information as to the use of reservoir water, and that owners generally had such a surplus that it would be turned down the streams for general use, and that after that rains would fill the reservoirs again. He reports plenty of water and no shortage in any stream.

He suggests amendment to the law so that all salaries be paid by the State, or charged to the county in which the labor is performed. In any event, salaries should be paid monthly.

The report is so far from furnishing data for the whole district that I see no form of tabulation that would be of any value.

Commissioner worked 180 days.....	\$ 900.00	
Ten deputy commissioners worked 793 days.....	1,982.50	
Total expense.....		\$2,882.50



District No. 41—W. O. Hersum, commissioner. Lower Uncompahgre river. The commissioner sends out a full crop report. The number of days water was used is not given, the commissioner not having started to distribute water until July, so no estimate of the duty of water can be given. The field books have not been received in time for me to estimate the use of water.

The commissioner suggests that there should be an irrigation engineer who should have control of all the waters of the State. That all commissioners and deputies should be paid monthly by the State, deputies to receive \$3.50 per day. That all ditches carrying less than 50 feet per second should be measured by the Stokes measuring gate, and larger ones by flumes rated after flood water. He reports that the condition of most of the flumes makes the rating more or less guess work.

CROP REPORT SHOWS:		
Alfalfa.....	19,845	acres.
Cereals.....	11,225	acres.
Grass.....	433.5	acres.
Orchards.....	3,198	acres.
Potatoes.....	1,143	acres.
Gardens.....	185	acres.
Sugar Beets.....	439.25	acres.
Other crops.....	306	acres.
Total.....		36,774 75 acres.

Commissioner worked 122 days.....	\$ 610.00	
Five deputies worked 471 days.....	1,177.50	
One deputy worked 113 days at \$.50.....	56.50	
Total.....		\$1,844.00

District No. 42—Walter Farmer, commissioner. Grand and Gunnison tributaries. The commissioner was not employed over his whole district. The report is incomplete. The crop report is only for the Plateau valley and Kannah creek, and the use of water is only given for some small streams. No system of tabulation would be of value. Some of the field books will provide a valuable record for the streams reported.

The commissioner reports a plentiful supply of water and about all crops matured. The Cipolletti weir, which is in use, and the Stokes gate are recommended for measurement. He reports that the amount of water stored in the reservoirs cannot be reported because there are no gauge rods. He recommends that

all commissioners and deputies should be paid by the State, and states that the county commissioners objected to his putting in time in excess of what was needed to distribute water for the purpose of gathering crop reports.

The Commissioner worked 109 days.....	\$545.00	
Five deputies worked 385 days.....	962.50	
Total.....		\$1,507.50

District No. 60—C. H. Smith, commissioner. San Miguel river. The commissioner sends a full crop report and data as to the use of water. He reports good crops with the exception of the first crop of alfalfa. The season has been an active one as far as surveying and starting of ditches is concerned, and a good deal of work has been done along this line. He recommends the rectangular weir as being very satisfactory. He does not consider the system of per diem pay for a commissioner very satisfactory, taking into consideration the time that a commissioner is not employed, but must be ready for work if called; this criticism arising from the fact that he personally is only accustomed to work for such odd days in the week as he is needed.

## CROP REPORT SHOWS:

Alfalfa .....	4,101 acres.	
Grass .....	497 acres.	
Cereals.....	2,768 acres.	
Orchard .....	224 acres.	
Gardens.....	381 acres.	
Total.....		7,971 acres.

The report of water shows a use of 2.70 acre-feet per acre.

The reservoir statement shows that the Naturita Land and Cattle Company's reservoir was filled twice from Beaver creek and drawn off for use once in August and once in September. The Lone Cone reservoir from Naturita creek was filled once and drawn for use in August. No separate records of the use of reservoir water are furnished, both reservoirs being used to keep up the flow of the canals when the natural flow falls off.

The Commissioner worked 47 days.....	\$235.00	
Total.....		\$235.00

District No. 61—Fred Dixon, commissioner. Dolores drainage. The commissioner sends a full crop report and data as to the use of water in his district. On account of not having received the letter asking for further report as to his opinion on various questions he has not at present sent anything on these subjects.

CROP REPORT:		
Alfalfa.....	711	acres.
Grass, 440 being unirrigated.....	554	acres.
Corn.....	161.50	acres.
Orchards.....	23.50	acres.
Other.....	34.25	acres.
Total.....		14,84.25 acres.

Water report shows use of 1.58 acre-feet per acre.

Commissioner worked 93 days.....	\$465.00	
Total.....		\$465.00

District No. 62—J. P. Morgan, commissioner. Gunnison drainage. The commissioner has not been called out, and I have not heard from him this year.

District No. 68—John Merling, commissioner. Upper Uncompahgre. No report received up to date.

Districts Nos. 31, 32, 63 and 69—Are not adjudicated and have no commissioners; district No. 59 has recently been adjudicated, but has no commissioner.

## IRRIGATION DIVISION NO. 5.

Annual Report, 1905.

Glenwood Springs, Colo., February 7, 1906.

Hon. T. W. Jaycox, State Engineer, Denver, Colorado.

Dear Sir: I beg to submit herewith my report as irrigation division engineer of Division No. 5, for the irrigation season of 1905.

The snow fall during the winter of 1904-5 was greater than usual, and the early precipitation was also above normal, and the work of the season was therefore much more satisfactory and

successful than in many previous years. I think it safe to say that greater results were attained from an agricultural standpoint, and much more was accomplished in the line of irrigation, than during any other year in the history of the Western Slope.

The work of the season has been robbed of many of the disagreeable features which have heretofore characterized the administration of this office, and, I attribute this desirable result, first, to the efficiency of the various water commissioners, who, largely through my advice, have familiarized themselves with their work, and have throughout the season shown a commendable disposition toward the water users of the various districts. Another feature largely responsible for the successful administration is the attitude of the courts toward law-breakers, and the fact that it has been made plain that violations of the irrigation law would not be tolerated by the courts.

Another feature which has added very materially to the efficiency of the irrigation system of the Western Slope is the reservoir system, which is each year being brought into greater use. Many of the reservoirs are not yet fully completed, but they are used each season, and at the end of the season the dams are raised as much as possible, the work often being limited by the early frosts, but people of this section are looking forward to the time when the reservoirs will play an important part in the irrigation of western Colorado, and each year some new development along this line is begun. In fact, much of the water supply is now furnished by reservoirs of small capacity, the only large system of storage reservoirs that I recall in my division being the Battlement Mesa reservoirs near Grand valley, and these are not yet fully completed.

The trouble in the Divide Creek country in District No. 45, which has heretofore been reported to your office, has entirely subsided, and aside from the difficulty which the commissioner found in regulating and changing headgates as promptly as the ranchmen demanded, we have had little trouble in that section. The arrest of a violator in that territory and the punishment inflicted by Judge Shamate, to which my report of last year refers, had an excellent effect and seems to have made it plain that adjudications of water will be protected by the courts.

Heretofore, the most serious trouble I have encountered has been in the Roan Creek section, which prior to the last session of the Legislature was a part of Water District No. 39. On account of difference in construction placed upon the statute, there was constant dispute between Garfield and Mesa counties as to the payment of the salary of commissioner for District No. 39, and also as to his right to regulate that portion of the stream extending into Mesa county. At a conference held between the county commissioners and county attorneys of the two counties, at which Mr. Stokes (irrigation division engineer of Division No. 4) and myself were present by invitation, an amicable arrangement for



the division of this disputed territory was agreed upon, and this was afterward embodied in a bill which passed the Legislature, setting aside all of the territory irrigated from Roan creek and its tributaries in a separate water district known as District No. 70. Mr. George F. Newton was made water commissioner for the new district, and I can not refrain from at this time complimenting him upon the tactful and just manner in which he has distributed the water in his district.

The case of Hammerich et al. vs. Isola et al. is now pending in the Supreme Court on appeal from the District Court of Garfield county. This is a case wherein the defendants were decreed 3.6 cubic feet of water per second, over twenty years ago, but not until two years ago did they attempt to cultivate more than enough land to use one-half of this decreed amount of water at the stipulated ratio of 1 cubic foot to fifty acres. About two years ago, by means of a pipe-line, they succeeded in carrying water to the balance of their land and then demanded the difference of water between what they had theretofore used and the amount specified in their decree. Inasmuch as they had placed under cultivation the amount of land necessary to consume the decreed amount of water, I advised the water commissioner to give them the full amount of water adjudicated to them, which he undertook to do, whereupon the plaintiffs brought suit and a temporary injunction was secured. At the final hearing before Judge Shumate this injunction was dismissed and decision rendered in favor of defendants. The plaintiffs claimed in this case that defendants had never used the excess water, and that they (the plaintiffs) by reason of usage for a number of years had established preferred right to this water, especially since they denied any abandonment on the part of defendants, but claimed that they have never used the excess amount, and therefore had perfected no title whatever. The defendants, however, claimed that since they had applied the water to heretofore unused land at a great expense, and with full knowledge of plaintiffs who made no protest until after defendants had actually applied and used the water, that plaintiffs were barred from attacking their rights, which they claimed were ripened and perfected from the date on which they initiated the use of the disputed amount of water.

After the plaintiffs had appealed the case to the Supreme Court, their attorney sought to enjoin defendants from the use of the excess water pending a final determination of the case. The Supreme Court, after hearing arguments in the matter, denied the injunction, and defendants will this year be given water to the full amount of their decree, or in proportion to the amount of land cultivated in accordance with the established ratio fixed in this district.

As you are aware, field books were not furnished commissioners in time for use during the past season, and consequently

the data collected by them has not been of a very satisfactory character. I find upon going over the annual reports of the commissioners that there is a great discrepancy therein, and I think it would be well nigh impossible to tabulate these reports as seems to be contemplated in the law. I am certain that this difficulty will be eliminated so that for another season we may expect more careful data and more harmonious reports.

I am constantly working on a record or abstract of the ditches in the district, and if possible to secure the desired information from clerks of court I will have a complete and accurate abstract of all the decrees in my territory. I find great difficulty, however, in getting the desired information from some clerks, but am now taking the matter up with higher authorities and hope to succeed in my undertaking. In this connection I beg to remind you that at the time of taking my office I found nothing whatever in the way of records aside from a very few certified copies of decrees.

There has been considerable dispute and some unpleasant differences in portions of the division in regard to the measurement of water, this being occasioned principally by an almost utter lack of any sort of appliance for this purpose. I have been insisting more and more each year upon the construction of measuring flumes, weirs and headgates as provided by law, and I am pleased to report that with very few exceptions my requests have met with prompt compliance on the part of water users, many of whom have afterward thanked me for my assistance, declaring that their former neglect had worked to their own disadvantage.

As to the crops throughout my division they consist of alfalfa, potatoes, wheat, oats, peas and barley, with timothy hay in the higher altitudes, and during the past year about one thousand acres of sugar beets have been raised in Garfield, Pitkin and Eagle counties. This was a venture and there is quite a difference of opinion as to its success. The beets grown in the higher altitudes, while not so large as those in the lower valleys, it is claimed contain a much larger percentage of saccharine matter, and many of those who made a partial success at least of their experiment last year have contracted for larger acreage during the coming season, claiming that they will turn the experiments of 1905 to their profit during the coming year. The beets have been shipped to the factory at Grand Junction and have brought a price of \$5.00 per ton upon local side tracks.

I desire to express my confidence in the perpetuity of the water supply in this section of the country, which I believe will not be diminished during the coming years. My reason for this opinion is that the government through its Forest Reserve administration is undertaking to preserve (and I am certain will preserve) the forests in the higher altitudes and near the sources of supply of the large streams and the various small feeders in

this territory, and this attempt at the conservation of the snow fall, it seems to me, will insure us an abundant water supply in the years to come.

I think I have no definite recommendations or suggestions to offer aside from those contained in my previous reports.

I wish to acknowledge my obligation and appreciation of the assistance rendered me by your office, and also to commend at this time the faithfulness, efficiency and co-operation of the various water commissioners, with whom I have had the most pleasant relations during my official term.

Respectfully submitted,

A. J. DICKSON,

Irrigation Division Engineer Irrigation Division No. 5.

IRRIGATION DIVISION NO. 5.  
SUMMARY OF WATER COMMISSIONERS' REPORT FOR THE IRRIGATION SEASON OF 1905.

Name of Ditch	Amt. of ap- propriation, sec. ft.	CROPS IRRIGATED FROM CANAL IN ACRES								
		Alfalfa	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Sugar Beets	Other crops	Total Irrigated
District No. 37. ....	292. 28	4,800	2,721	2,481	3	46	334	42	1,318	12,251
District No. 39. ....	176. 2	2,372	129	572	749	.....	282	63	73	4,240
District No. 43. ....	51. 1	390	855	294	.....	.....	16	.....	10	1,555
District No. 44. ....	128. 2	3,392	2,605	888	.....	.....	.....	.....	13	6,900
District No. 45. ....	Not given	7,122	487	1,734	613	3	287	4	272	10,522
District No. 52. ....	42. 9	784	870	.....	.....	.....	7	.....	288	1,949
District No. 53. ....	165. 08	2,144	2,091	84	5	.....	17	.....	1,757	7,412
District No. 70. ....	152. 5	2,003	89	492	312	16	59	.....	112	3,213
	1008. 26	23,007	9,847	6,545	1,682	65	1,002	109	3,843	48,042



## IRRIGATION DIVISION NO. 5.

Annual Report, 1906.

Glenwood Springs, Colorado, November 28, 1906.

Hon. T. W. Jaycox, State Engineer, Denver, Colo.

Dear Sir—I have the honor to submit to you my annual report as irrigation division engineer for Irrigation Division No. 5, for the year 1906.

While the snowfall in the mountains last winter was by no means excessive, the water supply this summer has been excellent and with very few exceptions the supply during the past year was the best ever known in this division. So well supplied have been the streams that the calls for the services of the water commissioners have been, as a rule, fewer than in former years and for this reason the data which should be furnished by the commissioners is not so complete as usual.

This year I insisted that water commissioners while in the discharge of their duties in the distribution of water should collect such data as would be required in compiling their annual reports, and in this way I have been able to secure very complete reports from eight commissioners, or, I might say, from seven, as Mr. Clark, of No. 43, on account of the refusal of the county commissioners to pay him for his work, has apparently done the least work possible consistent with the provisions of his bond, and his report, therefore, does not cover all the ditches in his district.

Just here I think I may as well refer to the peculiar conditions in district No. 43. At the beginning of Governor McDonald's term of office, the Democratic county commissioners of Rio Blanco county seemed of the opinion that the term of office of J. M. Clark as water commissioner of district No. 43 had expired, and they proceeded to recommend one after another for appointment as his successor. The Governor apparently did not share their views on the subject and no appointment was made, whereupon the county commissioners refused to recognize Mr. Clark as water commissioner, and refused to pay him for his services. I have just heard that they paid him part of the amount last month, but do not understand that they have yet settled with him in full. This friction is very unpleasant to the irrigation officials, cannot help but work to the disadvantage of the farmers in time, and has been largely the cause of my failure to secure certified copies of the decrees for filing, to which I shall refer later.

During the year I have personally visited ten districts in my division and gave to the water commissioners and water consumers such assistance as was in my power. In advising and

co-operating with the county commissioners of Routt county, I was able to straighten out some tangles in districts 53 and 58 which might have caused more serious trouble later.

In each district I have found many crudities in the appliances for distributing water and often much carelessness in the methods of its distribution, but these defects have been easily remedied and in almost every instance both farmers and water commissioners have shown a willingness to co-operate with the division engineer in bringing about better and more uniform conditions in their districts.

Last spring I served several notices on the owners of ditches in need of headgates, rating flumes or weirs, and in most cases the matter was given prompt attention. This fall I served several other notices, but have not heard that these orders have yet been complied with, and as the only means of forcing compliance—that of turning off the water—cannot be made effective until the beginning of next year's irrigation season, I hardly expect the desired improvements to be made until that time.

I have heretofore recommended that your office prepare definite plans and instructions for putting in weirs, and I am pleased to learn that such plans are now in preparation in your office. I am sure they will prove an aid to the division engineers and water commissioners, as they will make it easier for us to secure the construction of weirs, which will be of real value.

I have been greatly annoyed by my failure to secure certified copies of the decrees from some of the districts, especially from the District Court at Steamboat Springs, Routt county, and Meeker, Rio Blanco county. The clerk of the District Court at Meeker informs me that the original decree has never yet been recorded in the records of his office, and while the court some years ago issued a book purporting to give all of the decrees of the general order of 1889, the present clerk claims he has never compared it with the original findings of the referee and the order of the court, and he therefore declines to certify the same as correct. I have received a few certified copies from this court, but seem unable to obtain a full list. I enclose my correspondence in regard to this matter. The District Court at Meeker has jurisdiction only over water district No. 43.

From the clerk of the court at Steamboat Springs, Routt county, I have secured a fair amount of information. That is to say, I was furnished by him with an abstract of the decrees in districts 44, 57 and 58, such abstracts being sufficient for compiling my register, but not meeting your requirements, which call for the filing of certified copies in your office. The county commissioners still hesitate to incur the expense of making the complete copies.

The clerk of the court at Red Cliff has recently furnished me a complete copy of the general decree and one supplemental

general decree for district No. 37. As this only includes decrees issued to June, 1904, I have asked for copies of all supplemental decrees. I have also asked him for complete decrees of districts Nos. 52 and 53, and he is now working on these. My register has been completed as far as I can go with the information at hand.

Throughout Division No. 5, on account of the abundant supply of water and the favorable weather conditions, crops have been excellent and prices very satisfactory, and the farmers are prosperous and happy. In district No. 38, of which I have no tabulated report, potatoes and sugar beets are two crops which have been very popular the past few years. From inquiry I find that the sugar beets have this year yielded from 12 to 22 tons per acre, the average, I think, being about 15 tons. Potatoes are always a good crop in this district and also in No. 39, and I very much regret that in these two districts the water commissioners were unable to make tabulated crop reports showing acreage and giving the other data called for in the blank reports. However, their inability to gather the desired data was owing to the plentiful supply of water, which made much less demand for the services of water commissioners than in previous seasons, and I think that is a cause for rejoicing.

In eight districts from which I have reports I find a total length of 1,048 miles of ditch, with an aggregate appropriation of 2,113 second-feet of water. Water was carried in these ditches a total of 45,522 days. On account of the commissioners not being busy all the time, their information must necessarily be meager in some respects and the reports are not complete enough to enable me to give the average amount of water daily during the season, a very important bit of information. Total acreage in alfalfa is 21,284; natural grasses, 26,771; cereals, 9,575; orchards, 819; market gardens, 62; potatoes, 762; sugar beets, 131; other crops, 11,433, a total irrigated area of 70,869. I submit herewith tabulated statement:

## IRRIGATION DIVISION NO. 5.

## SUMMARY OF WATER COMMISSIONERS' REPORTS FOR THE IRRIGATION SEASON OF 1906.

Name of Ditch	Aint of ap- propriation, sec. ft.	Length of Main Ditch, Miles	No. of days water car- ried from nat. stream	CROPS IRRIGATED FROM CANAL IN ACRES								COST, DOLLARS			
				Alfalfa	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Sugar Beets	Other crops	Total Irrigated	Superin- dence	Repairs	Improve- ments
District No. 37. ....	354	127	12,010	3,252	4,085	3,490	2	44	253	112	2,914	14,152	.....	.....	.....
District No. 43. ....	61	66	798	1,316	1,786	733	3	.....	16	.....	.....	3,853	.....	.....	\$1,775. 00
District No. 44. ....	376	181	7,045	4,533	6,102	1,973	3	.....	63	.....	4	12,678	.....	\$2,363. 00	172. 00
District No. 45. ....	403	119	4,069	6,739	653	2,272	485	6	297	.....	246	10,791	.....	550. 00	825. 00
District No. 52. ....	62	62	6,150	902	1,107	.....	2	.....	30	12	283	2,336	.....	365. 00	119. 50
District No. 53. ....	317	136	6,558	2,207	4,667	410	5	.....	13	.....	823	8,125	\$219. 55	348. 20	228. 16
District No. 58. ....	395	223	5,861	437	8,256	.....	.....	.....	.....	.....	6,935	15,628	.....	.....	.....
District No. 70. ....	145	134	3,031	1,898	115	637	319	12	90	7	228	3,306	.....	1,711. 00	360. 00
	2,113	1,048	45,522	21,284	26,771	9,515	819	62	762	131	11,433	70,869	\$219. 55	\$5,337. 20	\$3,479. 65



During July and August last on one trip over my division I traveled nearly 500 miles by conveyance. Between leaving my home and my return, two weeks later, I had passed through five counties, eight water districts, two judicial districts and three United States land office districts. I believe this trip was helpful to the farmers, and the water commissioners, I am sure, will gladly bear testimony as to its value to them.

With the assistance of your deputy, Mr. C. W. Beach, I endeavored to make some ditch gaugings in June, but we found the conditions so poor on account of inferior headgates and rating flumes that further attempts were abandoned. I have reasons for believing that the conditions in this respect will be much better next year.

During the past year numerous surveys have been made as well as some locations on water for power and manufacturing purposes under the Taylor law, which permits adjudications of water for purposes other than irrigation. What the future of these projects may be is a subject for the prophets, but at this time I believe no real work has been begun on any of these enterprises except that of the Central Colorado Power Company, which is now pushing work on what is known as the Shoshone project, located about ten miles up the Grand river from Glenwood Springs. If the original plans of this project shall ever be fully carried out this will prove the greatest power transmission agencies in the West. While both the point of diversion and point of return to the stream are situated in the Glenwood Grand canon, with no irrigable land between, I cannot see where any possible harm can come to the cause of irrigation from this project alone so far as this canon is concerned, but I can readily see how the irrigation interests might easily be placed in great jeopardy where, in order to irrigate a certain tract of land, it would be necessary to take water from a stream at a point between where a power company diverts the waters of the stream and the point at which they use it or return it to its natural channel.

I have no large reservoirs in my division, but a number of small ones which do much to supplement the late supply along the inferior streams. The largest storage reservoirs I recall in the division are the Battlement Mesa reservoirs, a chain of five lakes whose source of supply is Battlement creek, and the Antlers reservoir, taking water from Rifle creek. The Battlement system has been used to great value for many years, although the reservoirs are none of them entirely completed according to original plans and each year some of the dams are heightened and thus more water is stored each season than ever before. The Antlers reservoir is in course of construction, or rather re-building, and progress with it is slow.

## RECOMMENDATIONS.

I have heretofore made several recommendations in previous reports, and these I desire to reiterate. I have recommended the appointment of water commissioners by the Governor independent of any endorsement by county commissioners, and that they be paid from State funds. I have made this suggestion because the present system is very unsatisfactory—so much so, in fact, that the position is not sought by men of the ability which should characterize a water commissioner. My suggestion has been met with the statement that the plan is not feasible under the present condition of the State's finances. This fact, if it be a fact, does not change my belief that much better service will be secured and better results accrue to the agricultural interests of the State when the division engineer shall have power to call out the water commissioner in the spring, to dispense with his services at the close of the season, to audit his bill and to exercise closer supervision of the water commissioners' work than he is at present authorized by law to do.

I also believe that the duties of the division engineer should be more definitely defined by statute, that greater responsibilities should be placed upon him, and I think I need hardly add that his salary and expense allowance should be increased accordingly. I am strongly opposed to the present system which compels the division engineer to surrender his correspondence and certified decrees—two of the best working assets of his office.

Acknowledging my thanks to your office for many courtesies and much valuable advice and assistance rendered during the past year, I beg to remain,

Yours very truly,

A. J. DICKSON,

Irrigation Division Engineer Division No. 5.

RECOMMENDATIONS SUBMITTED BY THE IRRIGATION  
DIVISION ENGINEERS.

At the annual meeting of the irrigation division engineers, held in this office on November 30, 1906, it was suggested that the recommendations of the reports of the irrigation division engineers be brought together in a letter, and submitted to the State Engineer. The letter follows:

"Grand Junction, Colo., December 7, 1906.

"To the Hon. T. W. Jaycox, State Engineer, Denver, Colorado.

"Dear Sir—We, the undersigned irrigation division engineers of Colorado, respectfully submit to you the following recommendations as to our powers and duties, with the belief that the

changes suggested will lead to the more efficient, accurate and economical distribution of water.

"1. That the water commissioners shall be called out for duty by the division engineer, to whom notice shall be sent that there is need for his services.

"2. That the commissioner shall cease to perform services when notified so to do by the division engineer.

"3. That the number of assistants employed by the commissioner and the time of his employment shall be determined by the division engineer.

"4. That all bills submitted to the boards of county commissioners on account of services rendered by the commissioner or his assistants shall be approved by the division engineer. That no such bill shall be approved until full report has been made of the services rendered, and such other report as he may require.

"5. That the division engineer shall have power to suspend any commissioner, or order the suspension of any assistant, for neglect of duty or disobedience of orders, subject to revision by the State Engineer, who shall have power to appoint a deputy to fill the place of any commissioner so suspended.

"6. That the pay of the division engineers shall be raised, and the expense fund raised for such divisions as need it. That the pay shall be a straight annual salary.

"We respectfully ask you to recommend such legislation as shall effect the changes recommended.

"WM. RIST, Division No. 1.

"JOHN M. JACKSON, Division No. 2.

"DAN S. JONES, Division No. 3.

"ARTHUR H. STOKES, Division No. 4.

"A. J. DICKSON, Division No. 5."

I believe the recommendations herein made have been carefully considered, and are the results of the experience gained from the administration of the irrigation laws, by those officials, who have the best opportunity of observing the results obtained, and are deserving of the attention of the Legislature, and therefore earnestly recommend that the statutes be so amended as to incorporate therein the above recommendations of the irrigation division engineers.

## SUMMARY OF THE REPORTS OF DIVISION ENGINEERS FOR THE YEARS 1905-1906.

Reports of the division engineers for 1905 were received at the annual meeting of the division engineers with the State Engineer, held November 23, 1905, at the State Engineer's office. Reports for 1906 were received at the annual meeting of the divi-



sion engineers with the State Engineer, held November 30, 1906, at the State Engineer's office.

The division engineers' reports are compiled from the reports of the water commissioners of each division.

In the divisions where the water commissioners are on duty through the entire irrigation season, the reports received are fairly reliable and contain valuable information.

These irrigation divisions are No. 1, comprising the South Platte river and its tributaries, and the North Platte river and its tributaries. No. 2, comprising the Arkansas river and its tributaries. No. 3, comprising the Rio Grande river and its tributaries. No. 4 contains such rivers as San Juan, Las Animas, Dolores, San Miguel, Uncompahgre and Gunnison rivers and their tributaries. In many of the water districts of this irrigation division the water commissioners are not called out for service until late in the season, when water gets low in tributaries, and then are only on duty for a short time. For this reason reports received have been incomplete and a tabulation of the reports would not give the full amounts for the entire division.

From water districts Nos. 33, 34, 41, 60, 62, 68 very good reports were received. Reports from water districts Nos. 40 and 42 were incomplete. No reports were received from water districts Nos. 28, 29, 30, 61, 69.

Water districts Nos. 31, 32 and 63 have no commissioners. It is unfortunate that such conditions exist in Division No. 4, as the data which should be collected is quite valuable.

In Irrigation Division No. 5 eight of the eleven water commissioners made good reports. The remaining six water districts have no commissioners.

The year 1905 was a good season from an irrigator's point of view. There was sufficient water to mature crops. The water supply was not cut short in any portion of the State. Satisfactory agricultural conditions existed and the yield of crops was excellent.

Colorado's agricultural resources are varied. Certain sections of the State are adapted to certain varieties of crops, due to soil and climate. Cantaloupes are suited to one locality, potatoes to others, peas to another, and certain sections are best adapted to fruit raising. Sugar beets apparently do equally well in all parts of our State. Alfalfa leads all other crops in acreage in 1905, there being 202,308 acres in Irrigation Division No. 1, and 218,301 acres in Irrigation Division No. 2. Cereals come next, with natural grasses third.

In 1905 there were grown 64,502 acres of sugar beets in Irrigation Division No. 1, and 27,076 in Irrigation Division No. 2. Reports of the acreage grown for the Grand Junction factory were incomplete.



In 1905, three new sugar beet factories were constructed in Colorado, namely, at Sterling, Lamar and Holly.

The season of 1906 was even more favorable for the irrigator. The water supply was distributed equally throughout the season, and high waters did little damage to canal headgates and dams.

The crop report for this year shows that cereals are in the lead, with alfalfa second and natural grasses third in acreage. Sugar beets again report an increase in acreage. Irrigation division No. 1 reports 81,375 acres, an increase of 16,776 acres over the year 1905. Irrigation division No. 2 reports 46,668 acres, an increase of 19,598 acres over the previous year. This shows an increase of 36,374 acres of sugar beets grown over the year previous.

There was no data available concerning the increase in the acreage at Grand Junction.

During the year 1906 three new sugar beet factories were constructed, namely, at Brush, Fort Morgan and Swink, and the foundation for a fourth one was laid at Las Animas, to be completed for the 1907 crop. The growth in acreage and value of this crop in the past seven years has been remarkable. The crop reports of our water commissioners give returns for 128,613 acres of sugar beets grown for the year 1906.

At this writing 16 factories are running in this State which manufacture sugar from sugar beets, and one is under construction.

Our soil and climate seem particularly well adapted for the growing of sugar beets, and the industry has a great future before it in Colorado.

D. S. Jones, division engineer division No. 3, caused a careful estimate to be made of the acreage of field peas grown in division No. 3. His report gives the enormous total of 145,000 acres. The field pea is planted, irrigated and grown to maturity and hogs, cattle and sheep are then pastured and fattened on the crop. There is no labor of harvesting, as the stock eat the standing crop. Peas have been a very profitable crop for the San Luis Valley farmer. The acreage has grown very rapidly in the past few years.

### COST OF SUPERINTENDENCE OF CANALS.

From the reports made by the water commissioners, the following table was compiled, showing the cost of superintendence and ditch riders per acre. This is really the cost of distributing the water. The cost of operating the canal is made up of cost of superintendence, maintenance and repairs. The table shows the cost of superintendence for the entire district. The several canals in the district may have a greater variation in cost per acre than the district themselves:

Water District No.	Cost per acre for Superintendence and distribution of water, 1905	Cost per acre for Superintendence and distribution of water, 1906
1. ....	\$0.09	\$0.16
2. ....	0.15	0.13
4. ....	0.32	0.21
5. ....	....	0.06
6. ....	0.09	0.09
7. ....	0.14	0.16
8. ....	0.50	0.30
9. ....	0.21	0.20
12. ....	....	0.23
14. ....	....	0.11
17. ....	....	0.14
64. ....	0.14	0.12
67. ....	....	0.17

No attempt was made to ascertain the cost per acre of maintenance and repairs, as, properly, these charges should be distributed over several years' expense, and any attempt at a comparison would be misleading.

### STORAGE RESERVOIRS.

When our farmers first began to grow crops which required late irrigation, the necessity of storage reservoirs for a late supply of water became apparent. The construction of an ample storage reservoir has started many an irrigation enterprise on the high road to success.

Storage reservoir development has reached its highest stage in this State in irrigation division No. 1. Rights in storage reservoir which are certain of being filled each year readily sell from \$400 to \$1,000 per 1,000,000 cubic feet.

During the year 1905 there was stored in division No. 1 12,453,941,297 cubic feet of water, equal to 265,242 acre-feet. In irrigation division No. 2, 79,106 acre-feet of water was stored.

The season of 1906 was even more favorable for storage. In irrigation division No. 1 there was stored in reservoirs 16,110,103,300 cubic feet of water, equal to 372,408 acre-feet. In Irrigation division No. 2 approximately 152,000 acre-feet of water has been stored. This makes a total of 524,408 acre-feet of water stored in irrigation divisions No. 1 and 2. Reports from irrigation divisions No. 3, 4 and 5 are meager and reservoir water does not play so important a part in the agriculture of these irrigation divisions.



Placing Steel Bars, Reinforced Concrete Slope Protection, Terry Lake Reservoir, Larimer County.



Completed Reinforced Concrete Slope Protection, Terry Lake Reservoir, Larimer County.





TABULATION OF THE REPORTS OF THE DIVISION ENGINEERS 1905.

Number of Division	Length of Main Ditch, Miles	Length of Laterals, Miles	No. Acre-Ft. used by canals for season	Total number of Acres that can be Irrigated.	Alfalfa	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Sugar Beets	Other Crops	Peas for Feeding	Total Irrigated
1.....	3319	1533	1,208,474	1,152,466	202,308	221,804	284,009	12,161	16,552	48,691	64,599	52,060	.....	895,042
2.....	1737	.....	.....	526,924	218,301	51,398	28,895	14,199	2,111	512	27,076	70,673	.....	338,921
3.....	1600	.....	.....	600,000	8,000	100,000	.....	100	.....	7,000	.....	170,000	40,000	.....
*4.....	.....	.....	.....	.....	16,104	11,086	19,445	2,251	79	1,380	660	453	.....	69,832
†5.....	.....	.....	.....	.....	23,007	9,847	6,545	1,682	65	1,002	109	3,843	.....	48,042
	.....	.....	.....	.....	467,720	394,005	338,894	30,393	167,807	51,585	92,444	296,829	40,000	1,351,837

\*Six districts out of seventeen reported.

†Eight districts out of seventeen reported.

TABULATION OF THE REPORTS OF THE DIVISION ENGINEERS 1906.

Number of Division	Length of Main Ditch, Miles	Length of Laterals, Miles	No. acre-feet used by canals for season	Total No. of acres that can be irrigated	Alfalfa Acres	Natural Grasses	Cereals	Orchards	Market Gardens	Potatoes	Sugar Beets	Other crops	Peas for feeding	Total Irrigated
1.....	3314	1927	1,228,821	1, 10,125	225,495	204,907	328,357	12,786	18,132	43,748	81,375	34,937	.....	921,675
2.....	2840	2147	1,607,292	533,737	163,464	49,424	67,051	14,453	2,962	799	46,668	31,913	.....	376,734
3.....	1274	.....	.....	* 600,000	10,444	124,881	118,460	64	189	7,390	.....	.....	145,813	408,441
4†.....	.....	.....	.....	* 250,000	28,031	23,761	19,863	3,565	575	1,155	439	617	.....	72,236
5‡.....	1048	.....	.....	* 200,000	21,284	26,771	9,515	819	62	762	131	11,433	.....	70,869
				2,893,862	449,318	429,744	543,246	31,687	21,820	53,754	12 ,613	78,910	145,813	1,852,955

\* Estimated for entire irrigation division.

† Six districts out of seventeen reported.

‡ Eight districts out of seventeen reported.

# REPORTS OF WATER COMMISSIONERS

OF

DISTRICTS NOS. 2, 3, 9, 16, 17, 40

1906

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While the State Engineer has general supervision over the distribution of water in the State, it is the water commissioner who does the actual work of distributing the water and who comes in direct contact with the water users. The water commissioner has his troubles. These troubles may be divided into two general classes, namely: difficulties attending the discharge of his duties and difficulties attending the collection of salary. Both these troubles are of a discouraging nature. I have selected several water commissioners' reports for the year 1906 and publish them herewith. These reports do not exaggerate conditions. They give a very good idea of the difficulties water commissioners encounter. A careful perusal of these reports is very instructive.

## WATER DISTRICT NO. 2.

Denver, Colorado, November 24, 1906.

To the Honorable William Rist,

Division Engineer of Irrigation Division Number One,

State House, Denver, Colorado.

Sir—I have the honor to submit herewith a report of my work for the years nineteen hundred five and nineteen hundred six, in accordance with your favor of September twentieth.

My work for the years nineteen hundred five and nineteen hundred six has been entirely satisfactory to me and also, I believe, to the water users in District Number Two.

I have had two suits brought against me in my official capacity, both of which have now been settled. The first was

brought by the Meadow Island Ditch Company vs. The Beeman Ditch, with which case you are doubtless familiar; and the second was brought by the Meadow Island Irrigation Company to restrain the water commissioners from interfering with said companies in the use of the waters from Big Dry creek and the Wheeler slough. These last mentioned cases were the result of an order from the water officers to said companies to put in measuring flumes so that the water officers could ascertain the amount of water derived from the Wheeler slough and the Big Dry creek. These cases have now been dismissed, leaving conditions practically the same as when the suits were first instituted.

Through the efforts of the State Engineer, there have been established two gauging stations, one at Henderson and one at Fort Lupton, both of which have been a great help to me during the past two years. Most of the ditches in the district have rating flumes and are rated, but in order to do complete justice to all, each ditch should be rated once a year. Practically all of the headgates and dams in the district are in good condition and whenever one is out of repair, I promptly notify the owner and they, as promptly, make repairs.

I have two deputies, whom I require to report to me, once a day, the conditions existing in their division. Most of my own time during the irrigation season is spent on the river with my deputies. I receive five dollars per day and am employed every day of the year. My deputies get two dollars and fifty cents per day and are employed seven months out of each year.

In conclusion I beg to make the following suggestions:

First: I suggest that there be either more stringent laws enacted or more rigid enforcement of the law now existing, preventing the transfer of excess appropriations. During my time in office I have persistently opposed such transfers and shall continue to do so.

Second: I recommend that the water commissioners be paid by the State, for the reason that each year more land is put under irrigation and the districts are extending into more counties, making it very difficult, if not impossible, to apportion the pay of the water officers among the counties, to the satisfaction of the counties.

Third: I recommend the enactment of a law giving the water officers the power and right to determine when a ditch is using more water than actually necessary. There are, to my personal knowledge, several ditches in the district which are so using more water than actually needed.

Respectfully submitted,

CHAS. M. JUMP,  
Water Commissioner District Number Two.



## WATER DISTRICT NO. 3.

Laporte, Colo., November 13, 1906.

Mr. William Rist,  
Division Engineer,  
Denver, Colo.

Dear Sir—In obedience to your letter of September 20th and 22nd, I beg leave to report as follows:

There has been during the season of 1906 about 1,000 acres of grain raised in District No. 3 without any irrigation, which gave a yield of about 30 bushels on an average to the acre. Then, just outside of District No. 3, and not really in any district, there has been about 3,500 acres of grain raised which produced about 30 bushels on an average. This season of 1906 has been unusually favorable to dry farming, and I am afraid that the results obtained would not be a fair criterion of what can be done in the future.

Besides having a good rainfall, we had also a good supply of water for irrigation and more stored water than ever before, so that there was no loss of crops this year for want of water. The acreage and yield of irrigated crops are both a great deal larger than ever before and the four sugar factories in this district are taxed to their utmost to get the beet crop used up, and more would have been raised if the farmers could have contracted for them. The sugar company had to quit making contracts last spring when it found that it had all contracted for that the factories could handle.

In regard to any changes in the law, I will only suggest that we need very much, in my opinion, that a storage season be established. Our most valuable crops have to depend almost entirely on stored water and I find that the old ditches that have the best irrigation rights are inclined to waste a great deal of water in the fall, winter and spring on the pretense that it is needed for irrigation, when you know there is not one foot in twenty so used.

There are a good many ditches that have not yet put in measuring flumes and some that have not even headgates. Now, I believe that the law requiring these has been on the statute books long enough to give everyone time to comply with it, and I think it would not be out of order to use a little force to have all comply with the law in this regard.

I do not usually have any deputies engaged, but this year I had an assistant for twenty days, who was paid \$35.00 for work done in August and \$15.00 for work done in September. I have been paid an average of \$150.00 each month during the last two years.

In conclusion, I would recommend that the State Engineer should insist that the owners of all reservoirs in the mountains

should have the actual capacity of their reservoirs determined by the State Engineer.

Yours very respectfully,

(Signed) J. L. ARMSTRONG.

### WATER DISTRICT NO. 9.

Morrison, Colo., November 19, 1906.

William Rist, Div. Eng.,

State House, Denver, Colo.

Dear Sir—Replying to the letter submitted by you, from the State Engineer, concerning an expression as to changes in system of payment of salaries, will say:

I have no suggestions to offer as regards the present system governing salaries, provided the system can be enforced. I have experienced much difficulty in collecting my salary at all, and have failed, so far, to collect one-third of it for the past two years. Last year the board of commissioners in Arapahoe were advised by the county attorney not to allow pay for Sunday work. The board acted on this advice and some time afterward reconsidered and decided to allow the old bill of \$87.50, but the bill is still unpaid. This year the joint boards of Jefferson and Arapahoe counties decided that Clear Creek county should be included in the division of salaries for my district, and I was advised that I must look to Clear Creek county for one-third of my pay from April 1, 1906. They further decided that I must look to that county for one-third of my back pay as far as April 1, 1905, claiming they had overpaid me. On account of these rulings I am unable to collect about \$800.00 that is due me. Any revision of this system of payment will be appreciated by,

Yours respectfully,

JOHN W. McLEAN.

### WATER DISTRICT NO. 16.

To the Honorable John M. Jackson,

Division Engineer, Irrigation Division No. 2,

Pueblo, Colorado.

Dear Sir—In submitting this report for the year ending in the fall of 1906, I desire to say that we have had a good yield of alfalfa and native grass hay and the best grain crop for the past four years. The fruit crop was a total failure owing to the severe hail storms of last year and the late frosts this spring. All other crops, with the exception of fruit, have been in proportion to the hay and grain. There has been plenty of water for

all ditches this season, but all was used for irrigation and none was used for storage. There are twenty-three reservoirs in the district, but none of them have impounded water this season, except the Huerfano Lake, in the lower part of the district. Owing to the great number of small streams in this district—twenty-eight in number, all having from five to ten ditches, ranging in length from three to twenty miles—it has required a force of six deputies continuously occupied to keep track of the ditches. This does not include the two principal streams, the Huerfano and Cucharas, running in the neighborhood of 150 miles. The ranchmen are beginning to find out that there is more economy in using less water than they used to, and they raise the same amount of crop, and in some cases better crops, than they did when they applied an excess of water. By limiting the application of the water to actual necessity, they benefit themselves and thereby help their neighbors who have later priorities. With the exception of a few minor offenses, my authority has been well recognized and respected throughout the district. There are very few good head-gates and measuring flumes in this district; although a number of new gates have been put in this season, the floods of the summer soon destroyed them. During the season two arrests were made for stealing water, and in both cases the defendants pleaded guilty and were fined \$5.00 and \$10.00 respectively. These fines were imposed by the nearest justice of the peace.

In this connection I desire to recommend the following changes in the irrigation laws: (1) That the jurisdiction in cases of violation of the irrigation laws be taken from the Justice Courts and placed in the County Courts. (2) That the district attorney and his deputies and assistants be empowered to prosecute all such cases of violation of the irrigation laws. Under the present state of the law we are forced to take an offender before the nearest justice of the peace, who is usually a farmer and a water user, and he is sure, in most all cases, to let his neighbor off with the minimum penalty—a nominal fine. In the cases above mentioned the parties had been running from seven to ten feet of water for 48 hours, and they were very glad to pay a small fine for that amount of water; in fact, they both said that it was cheaper to steal water than to buy it. If jurisdiction were placed in the County Courts the enforcement of the irrigation statutes would be greatly facilitated and the penalties would be sure and severe enough to insure respect for the law.

I would also recommend that the salary of deputy water commissioners be raised from \$2.50 to \$3.50 per day. We cannot get good men to do the work at a lower figure. A man has to use teams and pay expenses along the route. At the time the deputies are most needed they are engaged in working their own crops.

Very respectfully yours,

DAVID E. FARR,

Water Commissioner District No. 16.



## WATER DISTRICT NO. 17.

Rocky Ford, Colo., Nov. 14th, 1906.

Mr. John M. Jackson,

The Irrigation Division Engineer,

Pueblo, Colorado.

Dear Sir: I have the honor to report the following for the irrigation season ending September 30th, 1906.

This season has been one of the most prosperous that we have ever had in this district. Although there was a scarcity of water during the earlier part of the season, and the shortage extended further into the summer than I ever have known before, as it was the 12th of June before there was sufficient water for all ditches, which is two to four weeks later than usual: but after that time we had sufficient water to mature all crops, and the yield has been satisfactory to all. In the latter part of the season there has been more water than I have known before, and all of the water west of La Junta has been used for direct irrigation or has been stored in reservoirs for future use.

There has been stored in reservoirs during the past year the following amounts in acre feet:

Louis Reservoir, 860 acre feet, of which 620 has been used for irrigation, leaving on hand 240 acre feet:

Box Springs Reservoir, had left over from last year 50 acre feet, have stored during this season 520 acre feet, have used 520 acre feet for the irrigation of crops, leaving a balance on hand of 50 acre feet.

Holbrook Reservoir has stored during the past year 8,000 acre feet, have used for irrigation 4,000 acre feet, and have left in their reservoir 4,000 acre feet.

Great Plains Reservoirs: I have been unable to get any report from the manager of these reservoirs as to the amount of water used, but as near as I have been able to determine, they had on hand last October 1st about 90,000 acre feet; they have stored since that time 44,599 acre feet, and have in their reservoirs on October 20th, 93,578 acre feet, which would make a difference of 41,021 acre feet used in irrigation, less the loss for seepage and evaporation, which would amount to a great portion of this amount.

The amount of acre feet of water used per acre of land irrigated under the different large ditches is as follows:





Reinforced Concrete Drops, Comanche Canal, Water District No. 67.



Reinforced Concrete Radial Check Gates, Amity Canal at Big Sandy Creek, Water District No. 67.



Catlin.....	3.97 acre feet.
Las Animas Town.....	3.55 acre feet.
Rocky Ford.....	3.02 acre feet.
Las Animas Consolidated, (Jones).....	2.39 acre feet.
Fort Lyons.....	2.11 acre feet.
Lake, (Holbrook)*.....	1.54 acre feet.
Otero.....	1.30 acre feet.

\*This includes 4,000 acre feet of reservoir water.

The yield of wheat has averaged about 35 bushels per acre; oats have averaged 60 bushels per acre and several fields of oats have yielded as high as 100 bushels, with one field reported at 115 bushels per acre.

**Sugar Beets:** The yield of sugar beets will run from 10 to 30 tons per acre.

There has been shipped from this district 800 cars of cantaloupes of 350 crates each, which has netted the producer an average of 80 cents per crate or a total of \$224,000.00, besides a great many crates shipped by express to local points in the State which would considerably increase this amount.

**Stock Feeding:** There will be fed in this district the coming winter about 170,000 lambs; not as many as usual on account of the high price of lambs this fall.

There will also be fattened for the market about 8,000 head of cattle.

**Legislation:** In my opinion there should be a law passed compelling all Reservoir Companies to keep a record of water used from their reservoirs and furnish the water Commissioner with a record of the same. Also the laws should be amended so as to give the Water Commissioners supervision over the waste gates as well as the head-gates of ditches, because in the Arkansas Valley it is practically necessary to operate the ditches from the waste-gates as well as the head-gates on account of the enormous amount of sand passing down the river.

I believe also that there should be a law passed for an official gauger for the Arkansas River, whose duty it should be to rate ditches and to establish a rating station at different points on the river, also to re-rate ditches and stations during the irrigation season; also to give information to the Division Engineer and Water Commissioners of the different districts, for the better distribution of water from one district to another. And appropriation for the same. Said officer should be under and subject to the State Engineer's orders.

Respectfully submitted,

S. W. CRESSY,

Water Commissioner District No. 17.

## WATER DISTRICT NO. 40.

To Arthur H. Stokes, Irrigation Engineer Division No. 4, Grand Junction, Colorado.

I have no suggestions to make in reference to the laws of irrigation except as to the method of salary payments.

Section 2387 of 1 M. A. S. provides among other things, that each board of county commissioners into which a district extends shall pay its pro rata share of the water commissioner's salary. This is wrong for many reasons. Take, for instance, district No. 40, extending into three counties, to wit: Delta, Montrose and Gunnison; Delta county has four-fifths of all the ditches and hence the work of distribution; Montrose almost all of the balance, while Gunnison county has only three decreed ditches, which only require the time of the water commissioner for a short time to distribute the water. Yet under the present law Gunnison county must pay one-third of all of the expense of the distribution.

To obviate this I would suggest that the law be amended so as to have the expense of distribution paid by the State, or that the time actually spent be charged to the county in which the labor is performed. In any event the salaries should be paid monthly.

As to method of measurement of water I would suggest in mountainous districts, where water flows rapidly, an open flume is most satisfactory and the best method. The method in use in this district is a weir with contractions.

Complying with your request for a full report of district No. 40 I have the honor to report that the water supply in general has been abundant; that said district is well equipped with reservoir systems to furnish water in case of very dry seasons.

Also that there was more water stored than was used in the season of 1906 after allowing all ditches an abundance of water.

During the irrigation season of 1906 I employed ten (10) deputies, to wit:

Tom Ritter (Lower Surface Creek)	93 days, \$2.50 per day.....	\$232.50
Sam Ritter (Upper Surface Creek)	90 days, \$2.50 per day.....	225.00
F. S. Trickel (Surface Cr. Res.)	97 days, \$2.50 per day.....	242.50
W. D. Bryson (Forked T. and Trib.)	77 days, \$2.50 per day.....	192.50
M. Beckley (Forked T. and Sur.)	101 days, \$2.50 per day.....	252.50
E. W. Kelly (Leoux Cr.)	82 days, \$2.50 per day.....	205.00
Gordon Kelly (Leoux Cr. Res.)	83 days, \$2.50 per day.....	207.50
Wm. Melcher (Smith Fork and Trib.)	96 days, \$2.50 per day.....	240.00
John McNaughton (N. Fork and Trib.)	55 days, \$2.50 per day.....	137.50
Ray Doughty (Minn. Creek)	19 days, \$2.50 per day.....	47.50
Geo. Hider, Water Commissioner	180 days, \$5.00 per day.....	900.00



There has never been but two-thirds of any water bills for district No. 40 paid for two years. Gunnison has refused to pay any part of the water expense of my district.

Respectfully submitted this 23d day of November, 1906.

GEORGE HIDER,

Water Commissioner District No. 40.



## CHAPTER V.

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### SUMMARY OF DITCH AND RESERVOIR FILINGS.

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#### FILINGS.

During my term of office much needed new steel fixtures were placed in the vault. The filings and records of the office have been re-arranged and newly indexed. Much miscellaneous matter which did not have any direct connection with the office was taken out of the vault. Plans of all dams in the office have been carefully indexed and classified according to water districts. This entailed a large amount of work, but has enabled us to handle the business of the office with increased dispatch. The records of the office are becoming quite valuable and proper steps have been taken to preserve and carefully index them.

In 1903 an act was passed by the Legislature and approved April 11, which required filings to be made in the office of the State Engineer in duplicate. The filings were to be made on tracing cloth or other material adapted for permanent record. This act also gave the State Engineer authority to make such minor regulations in conformity with the act as in his judgment should be done.

This office has issued a circular of requirements for filing claims to water rights. This circular gives complete instructions how to file on water; as to size, material and scale of map, and what the map must show. It gives the form of statements to make and forms of affidavits to use. Some 1,500 copies of this circular have been printed and distributed. Everyone so requesting has been supplied with a copy.

When this act of the Legislature first went into effect, duplicate maps were required to be made upon mounted paper. Upon taking charge of the office, April 7, 1905, I found many objections to mounted paper as a material for filing record of maps. After giving the matter considerable study I decided to change the material to tracing cloth. On October 6, 1905, I caused to be sent out over 400 notices of the proposed change in the material to be used, to as many different engineers and surveyors. I have received many favorable comments on the change.

Some of the advantages tracing cloth has over mounted paper are as follows:

Tracing cloth is less bulky. It is as permanent a record. It costs less to prepare the maps. Both blue and white print copies can be made from a tracing cloth filing at a small expense. To obtain a copy from a mounted paper filing, it was necessary to have a tracing cloth copy made or have a lithograph.

During the biennial period ending November 30, 1906, a total number of 1,400 filings have been received on a total of 1,773 canals, pipe lines and reservoirs. These filings have been made in duplicate. It was necessary to carefully compare the two plats to determine if they filled the necessary requirements and then certify to both copies. The duplicate copy was then returned to be filed in the county in which the reservoir or canal was located.

The fees for filing are based as follows: One dollar for each source of supply, and one dollar for approving the duplicate plat. On this basis, a filing claiming one cubic foot per second would cost no more than a filing claiming one hundred cubic feet per second. Several cases have been noted where a claim was made for a small amount of water from several different sources and a dollar was charged for each source of supply. A charge based on the amount of water claimed would seem more equitable. I would recommend that our Legislature enact such a law.

Below is a summary of the filings made in this office since the publication of the last biennial report. The new filing law, approved April 11, 1903, went into effect July 9, 1903. A separate table was made to cover the period from December 1, 1902, to July 9, 1903, for filings made under the old law.



## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1902, to July 9, 1903.

Division No. 1.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	11	4,067 .89	18	9,672,464,460
2.....	5	273 .00	15	2,593,792,500
3.....	10	283 .50	7	260,580,000
4.....	4	339 .00	2	42,473,000
5.....	2	105 .50	3	30,214,670
6.....	7	450 .67	13	145,920,000
7.....	6	215 .50	10	5,740,502,280
8.....	5	36 .10	2	600,000,000
9.....	None	.....	1	13,939,200
23.....	1	4 .75	2	4,825,000,000
46.....	4	76 .50	1	18,621,900
47.....	2	151 .00	None	.....
48.....	7	86 .00	None	.....
64.....	2	569 .00	None	.....
65.....	None	.....	None	.....
Totals.....	66	6,658 .41	74	23,943,508,010

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1902, to July 9, 1903.

Division No. 2.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
10.....	16	779.98	9	757,039,500
11.....	6	3,170.58	None	.....
12.....	1	252.00	2	35,625,189
13.....	None	.....	1	5,610,528,000
14.....	6	140.40	1	5,314,320
15.....	None	.....	None	.....
16.....	1	0.50	1	150,000
17.....	10	1,541.00	None	.....
18.....	1	3.20	1	.....
19.....	None	.....	None	.....
49.....	None	.....	None	.....
66.....	None	.....	None	.....
67.....	8	2,071.00	1	247,333,680
Totals.....	49	7,958.66	16	6,655,990,689

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1902, to July 9, 1903.

Division No. 3.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
20.....	3	16.34	2	299,336,400
21.....	None	.....	None	.....
22.....	2	76.60	None	.....
24.....	None	.....	None	.....
25.....	1	2.00	1	.....
26.....	None	.....	None	.....
27.....	None	.....	None	.....
35.....	None	.....	None	.....
Totals.....	6	94.94	3	299,336,400

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1902, to July 9, 1903.

Division No. 4.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
28.....	11	72.6	None	.....
29.....	3	125.0	None	.....
30.....	6	2,331.5	1	2,170,000,000
31.....	2	106.0	None	.....
32.....	1	12.0	None	.....
33.....	3	42.0	None	.....
34.....	1	50.0	None	.....
40.....	9	167.5	15	44,662,120
41.....	2	22.0	1	1,633,500
42.....	1	6.46	8	140,552,870
59.....	5	182.4	None	.....
60.....	1	50.0	None	.....
61.....	5	32.0	None	.....
62.....	1	65.65	1	50,000
63.....	None	.....	None	.....
68.....	None	.....	None	.....
69.....	None	.....	None	.....
Totals.....	51	3,265.11	26	2,356,898,490

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1902, to July 9, 1903.

Division No. 5.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
36.....	4	51.3	None	.....
37.....	1	9.75	None	.....
38.....	11	37.92	None	.....
39.....	1	2.00	None	.....
43.....	9	58.36	1	1,306,800
44.....	11	397.98	1	4,886,720
45.....	3	8.00	None	.....
50.....	3	26.80	2	86,149,028,800
51.....	15	688.65	None	.....
52.....	None	.....	None	.....
53.....	6	8,590.90	8	42,538,970
54.....	3	199.1	None	.....
55.....	None	.....	None	.....
56.....	None	.....	1	42,240
57.....	4	76.0	None	.....
58.....	18	288.7	2	2,090,880
70.....	None	.....	None	.....
Totals.....	89	10,435.46	15	86,199,894,410



## SUMMARY OF DITCH AND RESERVOIR FILINGS

\*From July 9 to November 30, 1903.

Division No. 1.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	3	103.5	None	.....
2.....	None	.....	3	14,523,562
3.....	None	.....	None	.....
4.....	1	2.5	2	21,595,645
5.....	2	637.0	3	125,152,279
6.....	2	999.5	1	24,254,208
7.....	1	2.5	5	71,017,022
8.....	3	7.6	2	7,779,020
9.....	None	.....	1	18,504,160
23.....	1	2.0	None	.....
46.....	None	.....	None	.....
47.....	None	.....	None	.....
48.....	None	.....	None	.....
64.....	3	436.1	None	.....
65.....	None	.....	None	.....
Totals.....	16	2,190.70	17	282,825,896

\*On July 9, 1903, the filing law of 1903 went into effect.

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From July 9 to November 30, 1903.

Division No. 2.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
10.....	4	47.63	5	45,754,300
11.....	3	206.0	None	.....
12.....	None	.....	1	35,625,182
13.....	1	10.0	None	.....
14.....	1	14.4	2	51,854,880
15.....	None	.....	None	.....
16.....	None	.....	None	101,069,170
17.....	1	1,858.0	1	.....
18.....	None	.....	None	.....
19.....	None	.....	None	.....
49.....	None	.....	None	.....
66.....	None	.....	None	.....
67.....	None	.....	None	.....
Totals.....	10	2,136.03	9	234,303,532

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From July 9 to November 30, 1903.

Division No. 3.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
20.....	1	4.0	None	.....
21.....	None	.....	None	.....
22.....	None	.....	None	.....
24.....	None	.....	None	.....
25.....	None	.....	None	.....
26.....	None	.....	None	.....
27.....	None	.....	None	.....
35.....	None	.....	None	.....
Totals.....	1	4.0	None	.....

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From July 9 to November 30, 1903.

Division No. 4.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
28.....	None	.....	None	.....
29.....	None	.....	None	.....
30.....	4	40.0	None	.....
31.....	1	150.0	1	732,953,638
32.....	None	.....	None	.....
33.....	None	.....	None	.....
34.....	None	.....	None	.....
40.....	None	.....	1	13,989,900
41.....	None	.....	None	.....
42.....	1	6.5	7	44,123,565
59.....	2	33.0	None	6,000,000
60.....	1	3.0	1	.....
61.....	None	.....	None	.....
62.....	None	.....	None	.....
63.....	None	.....	None	.....
68.....	2	15.0	None	.....
69.....	None	.....	None	.....
Totals.....	11	247.5	10	797,037,103

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From July 9 to November 30, 1903.

Division No. 5.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
36.....	1	8.6	None	.....
37.....	None	.....	None	.....
38.....	1	1.0	1	6,159,937
39.....	None	.....	1	3,267,000
43.....	None	.....	None	.....
44.....	None	.....	None	.....
45.....	1	0.2	1	3,127,386
50.....	3	19.14	1	44,417,680
51.....	9	1,678.0	6	1,090,000,000
52.....	None	.....	None	.....
53.....	3	45.8	3	54,609,640
54.....	None	.....	None	.....
55.....	None	.....	None	.....
56.....	None	.....	None	.....
57.....	1	5.0	1	153,368,700
58.....	2	17.3	1	2,946,078
70.....	None	.....	None	.....
Totals.....	21	1,776.04	15	1,357,897,221



## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1903, to November 30, 1904.

## Division No. 1.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	6	493.85	6	1,814,383,150
2.....	11	321.7	5	326,898,986
3.....	12	2,246.0	9	1,285,422,944
4.....	2	125.6	5	262,006,402
5.....	17	2,033.0	7	1,052,578,423
6.....	12	716.1	30	885,942,756
7.....	10	412.8	16	578,834,509
8.....	7	488.80	7	12,822,719,215
9.....	1	35.0	2	14,982,848
23.....	9	168.25	4	12,078,889,437
46.....	2	26.67	5	88,338,142
47.....	2	21.20	None	.....
48.....	8	2,054.33	2	93,170,000
64.....	9	510.00	4	1,200,649,116
65.....	None	.....	None	.....
Totals.....	109	9,190.57	102	32,504,815,928

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1903, to November 30, 1904.

Division No. 2.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
10.....	7	64.60	11	254,825,215
11.....	7	153.60	4	338,057,160
12.....	4	67.53	6	186,123,157
13.....	9	25.30	7	85,747,124
14.....	2	24.80	1	136,100,000
15.....	1	4.14	1	324,055,864
16.....	1	7.00	1	85,246,920
17.....	9	1,772.1	3	3,031,758,092
18.....	None		None	
19.....	None		2	7,772,523,328
49.....	2	96.26	None	
66.....	None		None	
67.....	6	214.23	1	1,407,100
Totals.....	48	834.67	37	12,215,843,960

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1903, to November 30, 1904.

Division No. 3.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
20.....	1	5.6	1	3,240,589,572
21.....	1	400.0	2	1,518,778,000
22.....	3	36.84	None	
24.....	None		None	
25.....	6	18.19	None	
26.....	3	9.87	None	
27.....	None		None	
35.....	1	8.00	1	1,616,000
Totals.....	15	478.50	4	4,760,983,572

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1903, to November 30, 1904.

## Division No. 4.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
28.....	3	54.2	None	.....
29.....	2	54.00	2	17,951,946
30.....	19	2,309.12	4	4,959,936,507
31.....	3	196.30	None..	.....
32.....	None	.....	None	.....
33.....	6	96.91	3	907,898,087
34.....	3	2,029.00	4	68,483,303
40.....	8	30.25	24	251,536,093
41.....	3	31.76	4	4,508,381
42.....	18	1,294.21	6	7,044,483
59.....	3	12.51	None	.....
60.....	6	60.14	2	15,164,430
61.....	1	17.06	2	13,536,772
62.....	5	58.00	2	19,229,505
63.....	1	8.00	None	.....
68.....	4	37.50	None	.....
69.....	None	.....	None	.....
Totals .....	156	6,288.96	53	6,265,289,507

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1903, to November 30, 1904.

Division No. 5.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
36.....	13	1,075.6	None	.....
37.....	1	5.6	1	1,324,984,400
38.....	22	147.05	3	9,698,864
39.....	5	21.12	2	19,539,705
43.....	9	34.82	1	26,618
44.....	10	284.78	8	20,981,458
45.....	4	11.04	1	1,033,716
50.....	13	427.34	2	395,435,528
51.....	15	1,302.51	4	102,756,050
52.....	None	.....	None	.....
53.....	20	910.76	3	11,227,313
54.....	10	116.91	1	836,000
55.....	None	.....	None	.....
56.....	None	.....	None	.....
57.....	9	423.80	8	165,158,801
58.....	38	442.84	10	383,687,984
70.....	None	.....	None	.....
Totals.....	179	5,204.17	44	2,435,366,437



## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1904, to December 1, 1905.

## Division No. 1.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	15	5,779 .63	16	2,537,311,772
2.....	4	138 .52	16	230,281,779
3.....	18	2,227 .26	33	1,555,260,053
4.....	11	873 .44	19	2,502,280,246
5.....	6	80 .11	4	8,012,285,531
6.....	8	455 .92	19	759,812,200
7.....	10	65 .95	11	489,940,214
8.....	3	2 .64	11	10,266,681,974
9.....	2	140 .00	5	1,205,752,090
23.....	6	509 .21	2	9,943,693,960
46.....	9	148 .68	1	310,417,968
47.....	16	454 .92	1	75,350,317
48.....	3	50 .11	1	500,000
64.....	6	1,419 .00	3	1,913,877,320
65.....	1	27 .00	None	.....
Totals.....	118	13,372 .39	142	39,803,445,424

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1904, to December 1, 1905.

Division No. 2.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
10.....	7	31.06	6	13,350,241
11.....	5	371.15	1	29,575,000
12.....	1	27.00	1	159,170,549
13.....	3	8.00	1	225,941
14.....	6	375.79	9	740,900,080
15.....	3	7.14	5	2,097,637,566
16.....	2	855.00	3	1,391,081,200
17.....	4	118.00	3	73,555,110
18.....	3	111.02	1	3,249,901
19.....	None	.....	5	21,623,620
49.....	None	.....	None	.....
66.....	None	.....	None	.....
67.....	10	3,945.23	11	1,301,581,871
Totals.....	44	5,849.39	46	5,831,951,079

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1904, to December 1, 1905.

Division No. 3.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
20.....	6	5,018.00	2	7,095,597
21.....	None	.....	3	2,657,160,000
22.....	4	632.30	1	4,356,000,000
24.....	2	10.00	None	.....
25.....	2	0.99	None	.....
26.....	2	29.84	None	.....
27.....	None	.....	None	.....
35.....	1	20.00	1	1,862,316
Totals.....	17	5,711.13	7	7,022,117,913

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1904, to December 1, 1905.

Division No. 4.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
28.....	2	2.28	None	.....
29.....	1	12.85	1	6,210,350
30.....	12	2,146.24	4	4,925,627,937
31.....	2	10.00	None	.....
32.....	None	.....	None	.....
33.....	3	68.03	1	875,934,972
34.....	3	185.55	12	1,666,567,657
40.....	11	284.63	23	325,585,351
41.....	3	40.35	1	1,649,960
42.....	14	2,703.97	12	241,537,586
59.....	5	84.90	1	4,357,354,000
60.....	7	193.54	2	789,438,960
61.....	None	.....	None	.....
62.....	8	498.57	None	.....
63.....	None	.....	None	.....
68.....	5	184.05	None	.....
69.....	None	.....	None	.....
Totals.....	76	6,414.96	57	13,189,906,767

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1904, to December 1, 1905.

## Division No. 5.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
36.....	12	371.70	2	794,950,000
37.....	4	70.70	None	.....
38.....	11	381.81	2	209,264,394
39.....	10	33.14	None	.....
43.....	13	136.70	4	11,868,840
44.....	30	1,009.78	12	111,688,099
45.....	7	29.85	4	18,342,453
50.....	1	8.29	3	46,366,679
51.....	11	311.10	5	84,206,509
52.....	8	140.62	1	271,860,287
53.....	9	37.43	6	276,098,965
54.....	7	142.10	1	17,354,882
55.....	1	5.80	None	.....
56.....	6	3.02	None	.....
57.....	9	97.97	11	38,447,896
58.....	23	81.57	7	67,500,392
70.....	1	3.00	None	.....
Totals.....	163	2,864.38	58	1,947,949,396



## SUMMARY OF DITCH AND RESERVOIR FILINGS

Year Ending November 30, 1905.

IRRIGATION DIVISION NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	118	13,372.39	142	39,803,445,424
2.....	44	5,849.39	46	5,831,951,079
3.....	17	5,711.13	7	7,022,117,913
4.....	76	6,414.96	57	13,189,906,767
5.....	163	2,864.38	58	1,947,949,396
Totals for state.....	418	34,212.25	310	67,795,370,579

Equals 1,556,367 acre feet.

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1905, to November 30, 1906.

Division No. 1.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	37	3,758.7	43	3,453,879,302
2.....	10	434.56	28	22,387,740,000
3.....	20	2,395.1	29	10,151,535,000
4.....	8	350.3	5	565,254,000
5.....	7	184.	12	460,062,000
6.....	17	744.3	17	1,105,487,000
7.....	34	4,765.9	27	1,882,807,000
8.....	11	24.6	3	250,019,000
9.....	2	565.	3	422,027,000
23.....	11	484.6	4	4,746,449,000
46.....	3	125.7	None	.....
47.....	None	.....	None	.....
48.....	12	2,360.3	3	2,496,121,000
64.....	18	2,145.	12	7,193,764,000
65.....	1	9.9	None	.....
Totals.....	191	18,148.0	231	55,115,145,302

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1905, to November 30, 1906.

Division No. 2.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
10.....	16	1,889.7	16	2,071,130,000
11.....	7	569.	5	10,195,000
12.....	6	112.3	4	12,798,258,000
13.....	None	.....	None	.....
14.....	15	7,439.	28	2,466,816,000
15.....	None	.....	1	13,713,000
16.....	21	337.5	28	25,331,970,000
17.....	17	2,190.	9	1,027,805,000
18.....	5	2,438.	3	1,176,752,000
19.....	8	2,055.	6	2,109,945,000
49.....	None	.....	None	.....
66.....	None	.....	None	.....
67.....	28	4,245.4	14	5,568,046,000
Totals.....	123	21,275.9	114	52,574,630,000

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1905, to November 30, 1906.

## Division No. 3.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
20.....	2	779.2	4	1,228,686,000
21.....	None	.....	1	612,301,000
22.....	1	4.8	2	465,744,500
24.....	None	.....	None	.....
25.....	None	.....	None	.....
26.....	None	.....	None	.....
27.....	None	.....	None	.....
35.....	None	.....	None	.....
Totals.....	3	784.0	7	2,306,731,500

## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1905, to November 30, 1906.

Division No. 4.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
28.....	2	31.5	None	.....
29.....	3	21.1	None	.....
30.....	26	2,628.8	1	6,869,000
31.....	5	418.	1	3,797,313,000
32.....	3	12.	None	.....
33.....	13	399.8	7	1,366,304,000
34.....	4	830.4	1	1,154,000
40.....	25	599.3	22	870,644,000
41.....	1	6.	None	.....
42.....	17	3,070.6	10	104,648,000
59.....	7	814.1	1	17,156,000
60.....	20	1,775.	7	657,360,000
61.....	2	3.3	None	.....
62.....	3	36.	1	48,000
63.....	None	.....	None	.....
68.....	3	12.	None	.....
69.....	None	.....	None	.....
Totals.....	134	10,657.9	51	6,818,496,000



## SUMMARY OF DITCH AND RESERVOIR FILINGS

From December 1, 1905, to November 30, 1906.

Division No. 5.

DISTRICT NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
36.....	21	4,394.6	8	13,593,073,000
37.....	7	466.9	None	.....
38.....	30	3,028.6	8	304,770,000
39.....	8	2,030.5	3	23,135,000
43.....	35	436.8	7	11,338,000
44.....	10	228.9	5	22,423,000
45.....	6	48.8	2	4,647,000
50.....	1	400.	1	13,883,000
51.....	12	12,379.1	6	27,337,030,000
52.....	None	.....	None	.....
53.....	18	14,748.5	1	2,253,000
54.....	2	11.1	None	.....
55.....	1	4.5	None	.....
56.....	None	.....	None	.....
57.....	4	52.	4	21,220,000
58.....	32	1,026.5	10	436,094,000
70.....	None	.....	1	3,820,000
Totals.....	187	39,256.8	56	41,773,686,000

## SUMMARY OF DITCH AND RESERVOIR FILINGS

Year Ending November 30, 1906.

Divisions Nos. 1 to 5.

IRRIGATION DIVISION NO.	NUMBER OF DITCHES	AMOUNT CLAIMED IN CUBIC FEET PER SECOND	NUMBER OF RESERVOIRS	AMOUNT CLAIMED IN CUBIC FEET
1.....	191	18,148.0	231	55,115,145,302
2.....	123	21,275.9	114	52,574,630,000
3.....	638	90,122.6	459	158,868,688,802
4.....	134	10,657.9	51	6,818,496,000
5.....	187	39,256.8	56	41,773,686,000
Totals.....	1,273	179,461.2	911	275,150,646,104





Inlet Canal, in Logan County, to Julesburg Reservoir.



Rating Flume of Rocky Mountain Ditch, Near Golden, Water District No. 7.





## CHAPTER VI.

### SEEPAGE MEASUREMENTS.

Measurements of the seepage or return waters of some of the most important streams of the State have been made in the fall of each year since the publication of the Eleventh Biennial Report of this office, for the years 1901 and 1902. Whenever the gulches and creeks of the side drainage do not show any surface water above the ditches and were formerly dry, until the water from irrigation began to return, they are considered as seepage and not as natural inflows.

In some instances these quantities may include some waste water, but the amount is small and would be difficult to eliminate.

Ditches constructed to collect seepage along the banks, with no direct outtake or inflow of the river, have been considered as an outtake.

#### 1903.

In the year 1903 the measurements on the South Platte River were made by Harry True, on the Arkansas River by Amos Jones, on the Rio Grande and Conejos Rivers by Antoine Jacob and on the Uncompahgre River by Harry True. On the South Platte River in section from Lower Platte and Beaver Ditch to Balzac, the river was frozen and measurements were made through holes cut in the ice on December 4th and 5th. In the comparative tables of the South Platte River, the results given for 1903 are taken from bulletin No. 157 of the experiment state of the U. S. Department of Agriculture, as the measurements of that year by this office were made only on the lower portion of the river from Lower Platte and Beaver Ditch to Julesburg and cannot be compared with the other years in that table.

#### 1904.

For the year 1904 the measurements on the South Platte River were made by F. Cogswell. One small loss is noted near Sedgwick, due to very little irrigation on the large cattle and hay ranches along the river bottom, and tends to prove that there is an actual loss in carrying a stream like the South Platte River through broad and sandy beds.

#### 1905.

For the year 1905 the measurements on the South Platte River and Arkansas River were made by F. Cogswell.

## SOUTH PLATTE RIVER.

The slight gain at Haworth Bridge is due entirely to direct seepage into the City Ditch from the Northern Colorado Irrigation Company's ditch. Without this direct seepage the section would have shown a small loss. Snow and rain fell on October 14 and a portion of the increase in section near Littleton was due to melting snow. Snow and rain also fell on October 27-29, and a portion of the increase in section between Orchard and Fort Morgan was due to melting snow.

Between Balzac and Merino, the country on right of river was flooded by the Lower Platte and Beaver Ditch, filling water holes for the use of cattle during the winter. Many small lakes were thus formed within a mile of the river. The excessive amount of seepage in this section is no doubt due to this fact. The usual loss was encountered near Sedgwick.

## ARKANSAS RIVER.

In section between Buena Vista and Nathrop, part of the increase is due to seepage from irrigation under ditches on Cottonwood creek. In section between Nathrop and Brown's Station, part of the increase is due to seepage from irrigation under ditches on Chalk creek.

In section between Brown's Station and Salida, near the County Poor Farm, there were three seepage streams with a total discharge of 9.68 second feet, due to seepage from irrigation under ditches on South Arkansas river. The slight loss in section between Salida and Howard was not unexpected, as the valley is narrow, with very little irrigation, and not much seepage inflow can be expected. The increase in section between Howard and Texas creek is due, not to irrigation, but to a sub-surface inflow, of which the springs at foot of bluff below Coaldale are good examples. The side drainage is quite large, the grades of the small creeks are heavy and the sub-surface flow of these creeks may be much greater than the visible and measured flow at time of these measurements.

The increase in section between Texas creek and Canon City tends to prove that there may be some truth in the claim that there are numerous springs in the bed of the river through the "Royal Gorge."

An attempt was made on November 27-29 to continue the measurements down the river from Canon City, but freezing weather and floating ice made the results unreliable and the work was abandoned at Beaver Station.

1906.

For the year 1906 the measurements in the South Platte, the Cache la Poudre and the Big Thompson rivers were made by F. Cogswell; on the St. Vrain, the Boulder, the South Boulder

and Dry creeks by G. A. Wall; on Clear creek and Bear creek by C. W. Beach; on the Arkansas river by G. A. Wall; and on the Uncompahgre river by A. H. Stokes.

#### SOUTH PLATTE RIVER.

The loss in section between Last Chance Ditch and Haworth Bridge is due to lack of irrigation on land belonging to the Denver Water Co., and to the fact that in 1905 the Northern Colorado Irrigation Company's ditch "The Highline" carried very little water during the irrigation season.

When the seepage measurements were taken in October, 1905, the return of seepage was very marked at the foot of the bluff between the "Highline" and the "City Ditch." A special measurement was made to determine this direct seepage into this "City Ditch" between the headgate and the rating flume, a distance of about 1,000 feet, was found to be 2.50 second feet, thus giving to this section a small gain in place of a small loss.

In October 1906, although the "Highline" had been carrying much more water during the season than during 1905, this visible return water was almost entirely absent.

The bottom land on right of river between Littleton and Petersburg, was flooded by seepage water. Even seepage showed in the old excavation of the Petersburg Ditch at foot of bluff near wagon road, something unknown heretofore. This would tend to show that the rate of flow of return seepage water is extremely slow and that the entire effect of an excess or a shortage of water for irrigation may not be shown in the seepage measurements of the same year.

Measurements of the river were omitted at Fulton Dam, Platteville Dam and at mouth of St. Vrain creek on account of the high stage of water in the river. The excessive gain in the section between the Union Ditch and Evans lower bridge, is no doubt due to the fact that the fall of 70 second-feet in the river at Union Ditch during the night of October 18, may not have reached Evans when the river measurement was made in the afternoon of October 19.

These measurements were made at a very high stage of river flow, and at the close of a very wet season. The work had to be abandoned at Evans on account of the heavy snow storm of October 19. Since that date the large amount of water in the river prevented taking up the work again.

It was impossible to take the seepage measurements of the Rio Grande and Conejos rivers in 1906, owing to the large amount of water carried by these streams. This was true of the Arkansas river above La Junta. There was so much water above this point that it was impossible to gauge the river by wading, as it was necessary to do. At La Junta the Fort Lyon canal was carrying all the water in the river to storage reservoirs. This

made a good starting point and left the river free from excess water. All the water to be found in river below La Junta was seepage or from small tributaries.

## SEEPAGE MEASUREMENTS ON THE ARKANSAS RIVER

October and November, 1903.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Buena Vista to Nathrop .....	197.48	203.46	5.98	5.98
Brown's Station.....	219.67	262.32	42.65	48.63
Salida.....	256.98	247.30	— 9.68	38.45
Howard.....	259.62	309.19	49.57	88.52
Texas Creek.....	315.77	310.08	— 5.69	82.83
Canon City.....	319.91	322.28	2.37	85.20
Castle Rock.....	323.70	280.59	— 43.11	42.09
Florence Hot Springs.....	247.50	272.09	24.59	66.68
Beaver Station.....	272.09	260.74	— 11.35	55.33
Swallows Station.....	271.64	251.28	— 20.36	34.97
Bessemer Canal.....	249.52	269.76	20.24	55.21
Pueblo, Union Ave. bridge.....	271.24	249.60	— 21.64	33.57
Orchard Grove.....	264.11	301.88	37.77	71.34
Vineland.....	286.04	270.25	— 15.79	55.55
Boone.....	275.68	279.02	3.34	58.89
Nepesta.....	275.65	288.82	13.17	72.06
Otero Dam.....	248.54	228.46	— 20.08	51.98
Jones Point.....	228.46	246.83	18.37	70.35
Holbrook Canal.....	261.62	262.83	1.21	71.56
Rocky Ford bridge.....	186.72	212.57	25.85	97.41
Fort Lyon Dam.....	189.86	203.28	13.42	110.83
La Junta bridge.....	0.60	6.64	6.04	116.87
Jones Ditch.....	7.14	22.17	15.03	131.40
Las Animas bridge.....	89.49	86.44	— 3.05	128.85
Hilton bridge below Ft. Lyon.....	86.80	101.89	15.09	143.94
Caddoa bridge.....	103.52	101.24	— 2.28	141.66
Amity Waste.....	101.24	88.93	— 12.31	129.35
Lamar bridge.....	0.55	7.30	6.75	136.10



## SEEPAGE MEASUREMENTS ON THE ARKANSAS RIVER

November, 1905.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Buena Vista to Nathrop .....	232.46	274.80	42.34	42.34
At Brown's Station.....	295.35	307.61	12.26	54.60
At Salida.....	304.43	330.30	25.87	80.47
At Howard.....	361.90	361.54	— 0.36	80.11
At Texas Creek.....	372.09	393.50	21.41	101.52
At Canon City.....	417.45	422.74	5.29	106.81

## SEEPAGE MEASUREMENTS ON THE ARKANSAS RIVER

October, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Ft. Lyons Dam to Ja Lunta.....	3.30	13.17	9.87	9.87
Robinson.....	13.17	30.21	17.04	26.91
Las Animas.....	41.65	68.95	27.30	54.21
Mile below Hilton.....	83.01	103.77	20.76	74.97
Caddoa bridge.....	115.13	120.57	5.44	80.41
Colo. Kansas Dam.....	120.57	108.64	— 11.93	68.48
Prowers.....	78.16	86.62	8.46	76.94
Lamar.....	86.62	86.22	— 0.40	76.54
Morse.....	15.18	27.34	12.16	88.70
Carlton.....	27.59	43.19	15.60	104.30
Granada.....	41.72	37.59	— 4.13	100.17
Holly.....	39.59	32.75	— 6.84	93.33

## SEEPAGE MEASUREMENTS ON BEAR CREEK

October, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Morrison to Cykler ranch.....	40.11	45.98	5.87	5.87
Below Pioneer Union ditch.....	53.74	53.40	0.34	5.53
Jefferson-Arapahoe county line.....	53.40	58.55	5.15	10.68
Near mouth.....	58.55	60.91	2.36	13.04

SEEPAGE MEASUREMENTS ON THE BIG THOMPSON  
RIVER.

November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Home Supply Dam to Barnes ditch.....	114.58	134.72	20.14	20.14
Loveland and Greeley canal.....	0.00	4.64	4.64	24.78
Lytle bridge.....	13.30	29.53	16.23	41.01
Below Hill and Brush ditch.....	24.76	31.51	6.75	47.76
Big Thompson and Platte river ditch.....	31.51	40.61	9.10	56.86
Below Evans Town ditch or St. Louis colony ditch No. 1.....	68.29	76.74	8.45	65.31

## SEEPAGE MEASUREMENTS ON BOULDER CREEK

November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Gaging Sta. to Valmont.....	51.22	62.36	11.14	11.14
Boulder and Weld county line.....	82.76	112.50	29.74	40.88
At mouth.....	89.77	88.25	1.52	39.36

# SEEPAGE MEASUREMENTS ON THE CACHE LA POUDE RIVER.

October and November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
From Gaging Station in Canon to new Mer- cer ditch.....	175.18	188.45	13.27	13.27
Larimer and Weld canal.....	77.30	81.40	4.10	17.37
No. 2 Reservoir Supply Ditch.....	80.60	93.30	12.70	30.07
Inlet to Fossil Creek reservoir.....	44.90	51.38	6.48	36.55
Strauss bridge.....	0.49	16.34	15.85	52.40
Cache la Poudre No. 2 canal.....	16.14	28.79	12.65	65.05
Eaton ditch.....	28.60	35.85	7.25	72.30
Jones ditch.....	39.03	60.58	21.55	93.85
Greeley pump house.....	58.80	117.09	58.29	152.14
Ogilvey ditch.....	115.20	126.13	10.93	163.07

# SEEPAGE MEASUREMENTS ON CLEAR CREEK

October and November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Mouth of Canon, three-fourths mile above Golden to crossing below Rocky Mountain ditch.....	141.49	136.43	5.06	5.06
Mt. Olivett station, head of slough.....	142.76	147.61	4.85	0.21
Arvada, mouth of slough.....	147.61	153.55	5.94	5.73
Clear Creek and Platte river ditch.....	166.84	174.18	7.34	13.07
Mouth at Brighton bridge.....	174.18	174.83	0.65	13.72

## SEEPAGE MEASUREMENTS ON THE CONEJOS RIVER

September, 1903.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
From Canon one-fourth mile above U. S.				
Gaging station to San Juan bridge.....	81.10	79.32	— 1.78	— 1.78
Conejos bridge.....	64.05	62.29	— 1.76	— 3.54
Cerritos.....	31.14	20.10	— 11.14	— 14.68
Below mouth of Rio San Antonito.....	7.65	11.06	3.41	— 11.27
Sanford bridge.....	4.55	13.08	8.53	— 2.74
Below McIntire Springs.....	30.29	33.54	3.25	0.51
Mouth.....	44.97	50.48	5.51	6.02

## SEEPAGE MEASUREMENTS ON DRY CREEK

November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Head gate to mouth.....	2.30	8.08	5.78	5.78



## SEEPAGE MEASUREMENTS ON THE RIO GRANDE

September, 1903.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
From South Fork to the U. S. Gaging station				
above Del Norte.....	323.98	324.58	0.60	0.60
Del Norte, opposite power house.....	307.74	328.24	20.50	21.10
Bridge at John Off's house.....	148.56	140.45	8.11	12.99
Prairie canal.....	132.73	133.57	0.84	13.83
Monte Vista.....	107.49	117.34	9.85	23.68
San Luis canal.....	37.08	43.88	6.80	30.48
Hickory-Jackson ditch.....	0.10	10.45	10.35	40.83
Rio Grande canal.....	7.34	9.47	2.13	42.96
Above mouth of Conejos river.....	14.27	17.08	2.81	45.77
Below La Sauces.....	52.24	54.85	2.61	48.38
State bridge above Colorado-New Mexico line.....	66.50	64.00	2.50	45.88

## SEEPAGE MEASUREMENTS ON SOUTH BOULDER CREEK

November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Gaging Station to Dry Creek.....	40.96	37.11	3.85	3.85
Dry Creek to mouth.....	25.37	31.43	6.06	2.21

# SEEPAGE MEASUREMENTS ON THE SOUTH PLATTE RIVER.

November and December, 1903.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Lower Platte and Beaver Ditch to Snyder..	245.12	285.23	40.11	40.11
Balzac.....	271.21	326.12	54.91	95.02
Merino.....	134.13	158.89	24.76	119.78
Atwood.....	10.78	50.57	39.79	159.57
Two miles below Pawnee Creek .....	15.53	26.48	10.95	170.52
Sterling.....	15.21	29.24	14.03	184.55
Hliff.....	33.46	54.10	20.64	205.19
Crook.....	53.04	89.11	36.07	241.26
Sedgwick.....	18.33	22.42	4.09	245.35
Below Lodge Pole Creek .....	2.50	6.53	4.03	249.38
Julesburg.....	6.53	11.06	4.53	253.91

SEEPAGE MEASUREMENTS ON THE SOUTH PLATTE  
RIVER.

October and November, 1904.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Waste gate of Northern Colo. Irr. Co.'s ditch to pipe to reservoir at Platte Canon sta. . .	50.40	57.40	7.00	7.00
Below Last Chance ditch. . . . .	20.40	37.40	17.00	24.00
Haworth bridge. . . . .	18.10	29.10	11.10	35.00
Littleton. . . . .	38.93	67.50	28.57	63.57
Denver, 16th st. viaduct. . . . .	76.05	133.30	57.25	120.82
Below Burlington ditch. . . . .	169.78	170.28	0.50	121.32
Below Fulton dam. . . . .	23.74	54.87	31.13	152.45
Brighton, lower bridge. . . . .	10.90	70.90	60.00	212.45
Below Platteville dam. . . . .	55.63	102.91	47.28	259.73
Platteville. . . . .	88.17	130.02	41.85	301.58
Above mouth of St. Vrain Creek. . . . .	69.88	99.80	29.92	331.50
Below waste gate of Union ditch. . . . .	154.35	169.70	15.35	346.85
Evans, lower bridge. . . . .	237.20	302.16	64.96	411.81
Above mouth of Cache la Poudre river. . . . .	264.15	288.25	24.10	435.91
Hardin. . . . .	454.80	543.88	89.08	524.99
Above Putnam ditch. . . . .	446.21	470.40	24.19	549.18
Orchard. . . . .	246.83	307.47	60.64	609.82
Weldon. . . . .	258.41	314.63	56.22	666.04
Fort Morgan. . . . .	311.96	332.00	20.04	686.08
Snyder. . . . .	311.55	375.43	63.88	749.96
Balzac, No. 22 ranch. . . . .	286.57	345.70	59.13	809.09
Merino. . . . .	308.03	360.00	51.97	861.06
Sterling. . . . .	218.57	278.32	59.75	920.81
Iliff. . . . .	265.32	295.85	30.53	951.34
Crook. . . . .	261.70	333.42	71.72	1023.06
Sedgwick. . . . .	217.20	209.32	7.88	1015.18
Julesburg. . . . .	72.14	94.62	22.48	1037.66

# SEEPAGE MEASUREMENTS ON THE SOUTH PLATTE RIVER.

October and November, 1905.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Denver Water Co.'s pipe intake to waste gate of Northern Colo. Irr. Co.'s ditch.....	114.00	120.60	6.60	6.60
Below Last Chance ditch.....	89.43	104.90	15.47	22.07
Haworth bridge.....	77.40	78.60	1.20	23.27
Littleton.....	93.18	145.34	52.16	75.43
Petersburg.....	128.43	139.20	10.77	86.20
Denver, 16th st. viaduct.....	168.07	193.03	24.96	111.16
Below Burlington ditch.....	243.80	263.45	19.65	130.81
Below Fulton dam.....	265.97	285.73	19.76	150.57
Brighton, lower bridge.....	204.30	230.99	26.69	177.26
Below Platteville dam.....	250.21	302.91	52.70	229.96
Platteville.....	257.40	269.92	12.52	242.48
Above mouth of St. Vrain Creek.....	85.10	113.38	28.28	270.76
Below waste gate of Union ditch.....	137.80	146.21	8.41	279.17
Evans, lower bridge.....	182.67	231.03	48.36	327.53
Above mouth of Cache la Poudre river.....	217.30	254.03	36.73	364.26
Kersey bridge.....	382.43	425.20	42.77	407.03
Hardin.....	423.41	476.75	53.34	460.37
Above Putnam ditch.....	466.50	472.20	5.70	466.07
Orchard.....	472.20	490.48	18.28	484.35
Weldon.....	492.00	562.73	70.73	555.08
Fort Morgan.....	406.30	458.35	52.05	607.13
Snyder.....	268.00	336.45	68.45	675.58
Balzac.....	286.76	337.00	50.24	725.82
Merino.....	337.00	425.02	88.02	813.84
Sterling.....	358.85	400.10	41.25	855.09
Iliff.....	337.57	374.88	37.31	892.40
Crook.....	360.50	423.80	63.30	955.70
Sedgwick.....	423.80	414.95	— 8.85	946.85
Julesburg.....	393.50	407.50	14.00	960.85



# SEEPAGE MEASUREMENTS ON THE SOUTH PLATTE RIVER.

October, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Denver Water Co.'s pipe intake to water gate				
of Northern Colo. Irr. Co.'s ditch.....	584.40	603.80	19.40	19.40
Below Last Chance ditch.....	227.52	242.99	15.47	34.87
Haworth bridge.....	236.60	229.45	7.15	27.72
Littleton.....	210.80	254.71	43.91	71.63
Petersburg.....	267.72	289.00	21.28	92.91
Denver, 16th st. viaduct.....	292.63	338.93	46.30	139.21
Below Burlington ditch.....	351.50	353.08	1.58	140.79
Brighton, lower bridge.....	386.15	490.63	104.48	245.27
Platteville.....	425.70	458.14	32.44	277.71
Above waste gate of Union ditch.....	554.50	588.72	34.22	311.93
Evans, lower bridge.....	576.00	686.01	110.01	421.94

# SEEPAGE MEASUREMENTS ON ST. VRAIN CREEK

October, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	CREEK		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Lyons to Oligarchy ditch.....	86.86	88.55	1.69	1.69
Below Niwot ditch.....	49.56	48.04	1.52	0.17
Boulder and Weld county line.....	68.19	73.88	5.69	5.86
Boulder creek.....	194.30	180.77	13.53	7.67
Fleming bridge.....	182.29	196.51	14.22	6.55
Mouth.....	187.83	211.26	23.43	29.98

# SEEPAGE MEASUREMENTS ON THE UNCOMPAHGRE RIVER.

October, 1903.

PLACE, WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Bachelor Switch to Eleventh Correction line	41.53	39.53	— 2.00	— 2.00
Ridgway.....	34.01	55.93	21.92	19.92
Seven miles below Ridgway or below Cow Creek.....	79.47	87.03	7.56	27.48
Juray-Montrose county line.....	89.33	100.23	10.90	38.38
Stark's bridge.....	80.27	94.46	14.19	52.57
Montrose.....	51.16	52.57	1.41	53.98
Spring Creek.....	14.14	39.74	25.60	79.58
Olathe.....	46.12	51.77	5.65	85.23
Chipeta Beaudry ditch.....	3.05	5.43	2.38	87.61
Delta bridge.....	0.00	32.63	32.63	120.24

# SEEPAGE MEASUREMENTS ON THE UNCOMPAHGRE RIVER.

October and November, 1906.

PLACE WHERE MEASUREMENTS WERE TAKEN	RIVER		SECTION GAIN OR LOSS	TOTAL GAIN OR LOSS
	INFLOW	OUTTAKE		
Bachelor Switch to Eleventh Correction line	55.93	61.96	6.03	6.03
Ridgway.....	72.74	76.07	3.33	9.36
Seven miles below Ridgway or below Cow Creek.....	121.96	135.02	13.06	22.42
Ouray-Montrose county line.....	138.67	136.35	— 2.32	20.10
Stark's bridge.....	127.60	142.26	14.66	34.76
Montrose.....	38.65	40.52	1.87	36.63
Olathe.....	67.93	89.14	21.21	57.84

## COMPARATIVE TABLE.

Showing the Increase in Volume of Bear Creek from Morrison to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACE WHERE MEASUREMENTS WERE TAKEN	OCT. 1900	SEPT. 1901	SEPT. 1902	1903 1904 1905	OCT. 1906
	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Cykler ranch.....					5.87
Below Pioneer Union ditch....	3.70	4.77	0.54		5.53
Jefferson-Arapahoe county line..	13.23	13.43	3.69		10.68
Near mouth.....	15.71	18.70	4.15		13.04

## COMPARATIVE TABLE.

Showing the Increase in Volume of the Big Thompson River, from Home Supply Dam to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE	NOV. 1879	NOV. 1898	1899	JULY 1900	SEPT. 1900	SEPT. AND JULY 1901
	Miles	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot
Langstoins.....	4½	.....	.....	.....	8.18	8.67	0.21
Barne's ditch.....	5	15.78	8.13	.....	.....	.....	.....
Loveland and Greeley ditch.....	8	20.40	11.63	.....	14.45	— 1.61	13.20
Farmer's ditch.....	11	.....	.....	.....	10.91	7.41	.....
Big Thompson ditch.....	15	32.78	24.94	.....	.....	.....	.....
Lytle bridge.....	16	.....	.....	.....	9.82	7.47	5.07
Hill and Brush ditch.....	21	37.30	31.56	.....	17.80	10.48	16.52
Big Thompson and Platte river ditch.....	26	49.72	41.15	.....	26.60	15.57	33.58
Evans Town ditch or St. Louis Colony ditch, No. 1.....	34	64.08	52.74	.....	51.85	27.07	53.65

## COMPARATIVE TABLE.

Showing the Increase in Volume of the Big Thompson River, from Home Supply Dam to Points Measured,  
Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE	JULY 1902	1903	1904	OCT. 1905	NOV. 1906
		Second-foot	Second-foot	Second-foot	Second-foot	Second-foot
	Miles					
Langstons.....	4½	6.64				
Barne's ditch.....	5				11.60	20.14
Loveland and Greeley ditch.....	8	8.90			16.79	24.78
Farmer's ditch.....	11					
Big Thompson ditch.....	15					
Lytle bridge.....	16	20.11			24.01	41.01
Hill and Brush ditch.....	21	22.06			26.33	47.76
Big Thompson and Platte river ditch.....	26	33.85			32.58	56.86
Evans Town ditch or St. Louis Colony ditch, No. 1.....	34	42.09			43.76	65.31



## COMPARATIVE TABLE.

Showing the Increase in Volume of Boulder Creek from Gauging Station Above Boulder to Points Measured, Due to the Return of Seepage Water, as published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	OCT. 1900	SEPT. 1901	SEPT. 1902	1903 1904 1905	NOV. 1906
	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Valmont.....	13.63	12.78	6.23	.. No Report ..	11.14
Leggit's Crossing.....	17.49	15.11	11.11	..	.....
Boulder and Weld county line..	29.09	17.99	12.32	..	40.88
Near mouth.....	27.60	16.19	12.48	..	39.36

## COMPARATIVE TABLE.

Showing the Increase in Volume of the Cache la Poudre River, from the Canon to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE	OCT. 1885	OCT. 1889	OCT. 1890	OCT. 1891	MARCH 1892	OCT. 1892	NOV. 1893
	Miles	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot
New Mercer ditch.....	7	.....	.....	.....	.....	.....	.....	.....
Larimer and Weld canal.....	10	11.86	11.27	25.79	18.26	.....	15.37	31.25
No. 2 Reservoir Supply ditch.....	14½	.....	.....	.....	.....	.....	.....	.....
Box Elder ditch.....	17	.....	.....	.....	.....	.....	.....	.....
Inlet to Fossil Creek reservoir.....	17½	.....	.....	.....	.....	.....	.....	.....
Strauss bridge.....	19½	.....	.....	.....	.....	.....	.....	.....
Cache la Poudre No. 2 canal.....	22	37.36	48.06	39.45	26.97	.....	27.40	43.19
Eaton ditch.....	25	.....	.....	.....	.....	57.31	33.37	38.38
Jones ditch.....	32½	.....	.....	.....	.....	.....	.....	.....
Greeley No. 3 ditch.....	34	.....	.....	.....	.....	.....	.....	.....
Greeley pump house.....	37½	.....	.....	56.70	21.85	86.35	55.18	57.59
Ogilvey ditch.....	40	86.90	92.56	77.57	.....	96.11	72.49	81.18
Camp ditch.....	40½	.....	.....	.....	.....	.....	.....	.....
Mouth.....	43½	.....	98.97	100.79	79.53	.....	101.65	98.68

# COMPARATIVE TABLE.

## Of the Cache la Poudre River, etc.

PLACES WHERE MEASUREMENTS WERE TAKEN									
	DISTANCE	MARCH 1894	AUG. 1894	OCT. 1895	NOV.* 1896	1897 1898 1899	JULY AND AUG. 1900	SEPT. 1900	
		Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot	Second-foot
Miles									
New Mercer ditch.....	7						5 08	4 38	
Larimer and Weld Canal.....	10	1 57	0 77	19 62			1 95	8 53	
No. 2 Reservoir Supply ditch.....	14½	5 02		49 25		Measurements	— 12 82	12 09	
Box Elder ditch.....	17							17 44	
Inlet to Fossil Creek reservoir.....	17½								
Strauss bridge.....	19½		15 03	55 34		Measurements	— 16 56	23 58	
Cache la Poudre No. 2 canal.....	22	32 22	18 15	62 85			— 33 40	24 95	
Eaton ditch.....	25	25 59	30 01	69 84			— 27 77	27 98	
Jones ditch.....	32½					Measurements			
Greeley No. 3 ditch.....	34		42 69	77 19			— 21 47	29 28	
Greeley pump houses.....	37½	51 85	63 83	111 04			8 70	50 68	
Ogilvey ditch.....	40	61 90		118 78					
Camp ditch.....	40½					No Record			
Mouth.....	43½	82 32	118 16	165 15			42 99	75 17	
							86 38	110 02	

\*The measurements of 1896 can not be compared with the other years in this table, because when gaugings were taken in the upper portion of the river water was being exchanged between different ditches for day and night runs, and the results were affected thereby.

COMPARATIVE TABLE.  
Of the Cache la Poudre River, etc.

	DISTANCE	1901	1902	1903 1904 1905	OCT. 1906
	Miles	Second-feet	Second-feet	Second-feet	Second-feet
New Mercer ditch.....	7	2 88	8 82		13 27
Larimer and Weld canal.....	10	23 85	4 10		17 37
No. 2 Reservoir Supply ditch.....	14½	32 29	7 33		30 07
Box Elder ditch.....	17	40 76	13 37		
Inlet to Fossil Creek reservoir.....	17½				36 55
Strauss bridge.....	19½	38 10	18 53		52 40
Cache la Poudre No. 2 canal.....	22	31 90	22 21		65 05
Eaton ditch.....	25	38 14	29 19		72 30
Jones ditch.....	32½				93 85
Greeley No. 3 ditch.....	34	58 10	47 71		
Greeley pump house.....	37½	86 47	68 39		152 14
Ogilvey ditch.....	40				163 07
Camp ditch.....	40½	122 34	90 32		
Mouth.....	43½	167 30	119 43		

PLACES WHERE MEASUREMENTS WERE TAKEN

## COMPARATIVE TABLE.

Showing the Increase in Volume of Clear Creek from Mouth of Canon Three-fourths of a mile above Golden to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	OCT. AND NOV. 1900	SEPT. 1901	SEPT. 1902	1903 1904 1905	OCT. AND NOV. 1906
	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Below Rocky Mountain ditch ...	2.48	1.44	3.53	.....	5.06
Mt. Olivett Station, head of slough.....	5.54	1.71	4.15	No Record	0.21
Arvada, mouth of slough.....	9.90	8.25	7.53	.....	5.73
Clear Creek and Platte river ditch	13.65	22.77	8.62	.....	13.07
Near mouth.....	15.80	24.24	8.78	.....	13.72

## COMPARATIVE TABLE.

Showing the Increase in Volume of the Conejos River from U. S. Gauging Station at Mouth of Canon, to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	AUG. 1900	1901 1902	SEPT. 1903	1904 1905 1906
	Second-feet	Second-feet	Second-feet	Second-feet
San Juan bridge.....	2.09	.....	1.78	.....
Conejos bridge.....	20.03	.....	3.54	.....
Cerritos.....	19.73	.....	14.68	.....
Below mouth of Rio San Antonio.	20.75	No Record	11.27	No Record
Sanford bridge.....	.....	.....	2.74	.....
McIntire Place.....	14.10	.....	.....	.....
Below McIntire Springs.....	11.10	.....	0.51	.....
Mouth.....	4.22	.....	6.02	.....



## COMPARATIVE TABLE.

Showing the increase in Volume of the Rio Grande, from Railroad Station at South Fork to Points Measured, Due to The Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	1896 1897 1898 1899	AUG. 1900	1901 1902	SEPT. 1903	1904 1905 1906
	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
U. S. Gaging Station above Del Norte.....		48.15		0.60	
Above Del Norte canal.....		22.20			
Del Norte, opposite power house.....				21.10	
Bridge, at John Off's house.....		43.89		12.99	
Prairie canal.....		33.84		13.83	
Monte Vista.....		30.60		23.68	
San Luis canal.....	No Record	52.49	No Record	30.48	No Record
Hickory-Jackson ditch.....		66.47		40.83	
Alamosa.....		66.61			
Rio Grande canal.....				42.96	
Above mouth of Conejos river...		66.85		45.77	
Below Conejos, north branch....		66.50			
Below LaSauces.....		68.25		48.38	
State bridge above Colorado-New Mexico line.....		63.16		45.88	

## COMPARATIVE TABLE.

Showing the increase in Volume of South Boulder Creek from the Gauging Station at Mouth of Canon above Marshall to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer:

PLACES WHERE MEASUREMENTS WERE TAKEN	1900	1901 1902 1903 1904 1905	NOV. 1906
	Second-feet	Second-feet	Second-feet
Below Dry Creek bridge.....	0.93	No Record	
Dry Creek.....			3.85
Near mouth.....	1.05		2.21

## COMPARATIVE TABLE.

Showing the Increase in Volume of the South Platte River, from the Canon to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE	OCTOBER 1889	OCTOBER 1890	OCTOBER 1891	MARCH 1892	OCTOBER 1893
		Second-foot	Second-foot	Second-foot	Second-foot	Second-foot
Below Last Chance ditch.....	5					
Haworth bridge.....	8			27 57	25 32	18 41
Littleton.....	14	49 91	11 73	80 18	69 95	41 91
Petersburg.....	17					
Denver.....	24	50 91	55 61	96 38	129 56	83 18
Burlington ditch.....	28					
Fulton dam.....	35		94 41	138 85	141 51	127 03
Brighton.....	42	77 07	98 91	75 19	11 17	152 91
Platteville dam.....	50					
Evans No. 2 ditch.....	52					208 74
Platteville.....	58	133 38		226 93	180 54	218 82
Mouth of St. Vrain Creek.....	62		155 80	233 32		
Union ditch.....	67					252 81
Evans.....	74½	197 00	176 91	299 21	192 86	279 93
Mouth of Cache la Poudre river.....	77½		215 20	326 13	216 17	318 20

Kersey.....	80½	.....	.....	.....	.....	.....
Hoover ditch.....	83½	277.10	351.66	392.66	285.25	.....
Hardin.....	90½	.....	.....	.....	.....	387.23
Putnam ditch.....	102½	.....	333.60	418.80	330.61	365.78
Orchard.....	111	.....	.....	.....	.....	.....
Fort Morgan canal.....	117	305.92	360.58	434.05	360.09	414.33
Weldon.....	120	.....	.....	.....	.....	.....
Bijou Creek.....	126	307.03	367.09	472.14	431.74	464.64
Fort Morgan.....	129	.....	.....	.....	.....	.....
Snyder.....	140	.....	384.18	470.60	.....	479.67
Balzac.....	147	.....	.....	.....	.....	.....
Merino.....	158	385.58	405.71	550.33	.....	514.39
Sterling.....	171½	418.33	435.16	583.69	.....	548.15
Ihff.....	183	422.77	449.21	611.76	.....	572.99
Crook.....	200	.....	.....	598.69	.....	.....
Sedgwick or above Pole Creek.....	215	.....	.....	.....	.....	.....
Julesburg or state line.....	230	.....	.....	602.00	.....	.....

## COMPARATIVE TABLE.

Showing the Increase in Volume of the South Platte River, from the Canon to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE Miles	OCTOBER 1894	OCT., NOV. 1895	OCT., NOV. 1896	OCT., NOV. *1898	OCT., NOV., 1899	OCT., NOV., 1900
		Second-feet	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Below Last Chance ditch.....	5						
Haworth bridge.....	8	49.23	20.21	10.18	1.21	72.93	33.96
Littleton.....	14	74.82	75.44	24.94	27.65	133.89	74.13
Petersburg.....	17						
Denver.....	24	193.74	193.24	58.89	89.28	150.29	90.35
Burlington ditch.....	28						
Fulton dam.....	35	228.06	174.05	74.61	112.78	196.90	86.96
Brighton.....	42	278.04	207.13	126.18	138.94	274.30	160.62
Plateville dam.....	50					324.33	194.48
Evans No. 2 ditch.....	52	314.72	276.76	171.24	227.92		
Plateville.....	58	343.05	341.57	219.05	251.29	363.09	216.70
Mouth of St. Vrain creek.....	62						
Union ditch.....	67	398.70	362.28	228.78	328.44	410.74	257.76
Evans.....	74½	450.51	385.85	256.64	362.26	474.59	333.80
Mouth of Cache la Poudre river.....	77½	474.86	443.05	276.88	466.31		

Kersey.....	80½	549.75	557.58	309.71	482.47	564.07	353.43
Hoover ditch.....	83½	498.70	522.31	325.33	497.38		409.08
Hardin.....	90½	549.12	565.26	344.63	522.39	624.97	412.94
Putnam ditch.....	102½		671.86	344.99	553.41	628.22	439.54
Orchard.....	111						
Fort Morgan canal.....	117						
Weldon.....	120	617.43	717.78	375.38	568.32	715.51	469.01
Bijou Creek.....	126	676.88	800.92	392.85	594.40		
Fort Morgan.....	129		799.37	425.24	617.01	722.71	512.73
Snyder.....	140	707.64	814.19	478.03	654.14	795.34	596.50
Balzac.....	147						
Merino.....	158	766.31	959.45	544.24		889.21	682.04
Sterling.....	171½		1,006.25	576.84		962.94	744.07
Huff.....	183		1,023.24	598.20		1,009.13	749.26
Crook.....	200	810.11	975.19	629.28		1,078.51	772.90
Sedgwick or above Pole Creek.....	215		989.93			1,061.38	722.21
Julesburg or state line.....	230	775.94	942.30			1,102.61	800.19

\*Owing to heavy snow storms in October and November of 1897, and on account of the melting snow, it was found that the results were entirely untrustworthy as seepage measurements, and are therefore omitted.



## COMPARATIVE TABLE.

Showing the Increase in Volume of the South Platte River, from the Canon to Points Measured. Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE	OCTOBER 1901	OCT. NOV. 1902	U. S. DEPT. OF AGRICULTURE 1903	OCT. NOV. 1904	OCT. NOV. 1905	OCTOBER 1906
		Second-feet	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Below Last Chance ditch.....	5				24 00	22 07	34 87
Haworth bridge.....	8	21 22	5 04	31 64	35 00	23 27	27 72
Littleton.....	14	32 71	18 28	55 95	63 57	75 43	71 63
Petersburg.....	17					86 20	92 91
Denver.....	24	68 34	43 18	68 51	120 82	111 16	139 21
Burlington ditch.....	28				121 32	130 81	140 79
Fulton dam.....	35	90 06	61 12		152 45	150 57	
Brighton.....	42	141 03	91 85	172 11	212 45	177 26	245 27
Platteville dam.....	50	225 52	130 05		259 73	229 96	
Evans No. 2 ditch.....	52						
Platteville.....	58	272 30	158 09	216 53	301 58	242 48	277 71
Mouth of St. Vrain Creek.....	62				331 50	270 76	
Union ditch.....	67	331 75	194 74		346 85	279 70	311 93
Evans.....	74½	411 14	253 26	302 09	411 81	327 53	421 94
Mouth of Cache la Poudre river.....	77½				435 91	364 26	

Kersey.....	80½		297.13			407.03
Hoover ditch.....	83½	584.00				
Hartin.....	90½		330.02		524.99	460.37
Putnam ditch.....	102½	593.38	345.49	441.86	549.18	466.07
Orchard.....	111	619.31	355.71		609.82	484.35
Fort Morgan canal.....	117					
Wellton.....	120	615.87	427.95		666.04	555.08
Bijou Creek.....	126					
Fort Morgan.....	129	684.27	462.77	527.13	686.08	607.13
Snyder.....	140	750.14	524.10	573.37	749.96	675.58
Balzac.....	147				809.09	725.82
Merino.....	158	847.18	604.45	608.13	861.06	813.84
Sterling.....	171½	894.18	701.62	682.05	920.81	855.09
Hill.....	183	926.22	708.89	721.32	951.34	892.40
Crook.....	200	938.34	738.72	725.93	1,023.06	955.70
Sedgwick or above Pole Creek.....	215		738.82	727.64	1,015.18	946.85
Julesburg or state line.....	230	942.07	749.49	729.61	1,037.66	960.85

## COMPARATIVE TABLE.

Showing the Increase in Volume of the St. Vrain Creek, from the Gauging Station at Lyons to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	OCT. 1900	JULY AND AUG. 1901	AUG. 1902	1903 1904 1905	OCT. 1906
	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Oligarchy ditch.....	— 5.76	— 28.98	— 4.61	.....	1.69
Below Ni Wot ditch.....	— 2.91	— 21.80	— 1.87	.....	0.17
Boulder and Weld county line....	11.81	— 0.63	1.56	No Report	5.86
Boulder Creek.....	22.28	8.99	6.89		— 7.67
Fleming bridge.....	27.86	36.60	9.77		6.55
Near mouth.....	36.41	28.74	13.38	.....	29.98

## COMPARATIVE TABLE.

Showing the Increase in Volume of the Uncompahgre River, from Bachelor Switch near Ouray to Points Measured, Due to the Return of Seepage Water, as Published in the Biennial Reports of the State Engineer.

PLACES WHERE MEASUREMENTS WERE TAKEN	DISTANCE Miles	NOVEMBER 1ST TO 5TH 1900	OCTOBER 1901	NOVEMBER 1902	OCTOBER 19TH TO 24TH 1903	1904 1905	OCT. 1906
		Second-feet	Second-feet	Second-feet	Second-feet	Second-feet	Second-feet
Eleventh Correction line.....	6	1.10	— 0.69	6.91	— 2.00	.....	6.03
Ridgway.....	10	24.38	33.84	25.14	19.92	.....	9.36
Seven miles below Ridgway.....	17	21.73	47.51	39.40	27.48	.....	22.42
Ouray-Montrose county line.....	22	32.83	41.76	28.38	38.38	.....	20.10
Stark's bridge.....	29	43.16	57.60	47.28	52.57	No Report	34.76
Montrose.....	34	43.07	64.56	52.72	53.98	.....	36.63
Spring Creek.....	42	62.50	98.32	83.05	79.58	.....	.....
Olathe bridge.....	47	78.47	108.95	92.64	85.23	.....	57.84
Chipeta Beaudry ditch.....	53	.....	.....	.....	87.61	.....	.....
Boles and Manny ditch.....	.....	74.43	116.06	94.59	.....	.....	.....
Delta bridge.....	59	88.66	138.24	108.00	120.24	.....	.....





## CHAPTER VII.

## STREAM MEASUREMENTS.

This office has maintained gaging stations on and made frequent gagings of the following streams:

- Boulder Creek at Boulder.
- South Boulder Creek at Marshall.
- St. Vrain Creek at Lyons.
- St. Vrain Creek at Mouth.
- Big Thompson Creek at Arkins.
- South Platte River at Denver.
- South Platte River at Platteville.
- South Platte River at Orchard.
- Los Pinos River at Ignacio.

The results are published in this report.

In addition to this work, this office kept up gaging stations on the South Platte river at Fort Lupton and Henderson and on the Arkansas river at Nepesta and La Junta; on the Purgatoire river at Higbee for the aid of the water commissioners in the distribution of water.

The results obtained at these stations were eminently satisfactory and the work should be enlarged upon in the future.

This department has co-operated with the U. S. Geological Survey upon the request of the Director of the U. S. Geological Survey, by paying the observers at the following stations, since June 1, 1906:

- Arkansas River at Canon City.
- Arkansas River at Pueblo.
- Clear Creek at Forks Creek.
- South Fork of South Platte River at South Platte.
- South Platte River at South Platte.
- South Platte River at Denver.
- South Platte River at Kersey.
- South Platte River at Julesburg.
- Rio Grande River at Del Norte.
- Rio Grande River at Cincero.

The waters of Colorado are one of our chief sources of wealth. A knowledge of the available waters is of great value to prospective investors. Scarcely a day passes but what some one calls to look up the water supply of a stream either for irrigation or power purposes. Experience has taught capital the danger of an investment in an irrigation or power enterprise without a knowledge of the available supply of water. There is only one way for the public to obtain this knowledge, and that is by actual measurements and observations paid for by the State or Federal governments. Money thus expended is wisely expended, as it exploits our water supply and thereby aids in the development of the resources of the State. I cannot speak in too strong terms of the importance and value of this work. Co-operation with the U. S. Geological Survey is desirable. It gives greater scope to the work.

## ARKANSAS RIVER DRAINAGE.

Arkansas River at Oxford Farmers Dam at Nepesta, Colorado.

For the Year 1906.

STAGE OF WATER	MONTH											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum.....					2,410	4,000	4,500	2,410	1,750			
Minimum.....					770	980	560	210	130			
Mean.....					1,330	1,669	1,806	771	435			

Record for May is from May 15th to May 31st.

# DISCHARGES OF THE ARKANSAS RIVER AT THE FORT LYON CANAL DAM.

For the Year 1905.

MONTH	Carried by Canal Acre-feet	Amount Passing. Acre-feet	Total Acre-feet
January.....	2,870	6,850	9,720
February.....	3,864	8,800	12,664
March.....	25,126	5,036	30,162
April.....	63,680	111,048	174,728
May.....	46,672	204,598	251,270
June.....	77,502	153,068	230,570
July.....	25,464	10,050	35,514
August.....	25,764	18,270	44,034
September.....	18,452	120	18,572
October.....	14,238	.....	14,238
November.....	28,396	.....	28,396
December.....	12,276	14,150	26,426
TOTALS.....	344,304	531,990	876,294

The above record was furnished by Thomas Berry, Chief Engineer of the Arkansas Valley S. B. and I. L. Co., Lamar, Colo.

# ARKANSAS RIVER DISCHARGES AT FORT LYON CANAL DAM.

For the Year 1906.

MONTH	Carried by Canal Acre-feet	Amount Passing. Acre-feet	Total Acre-feet
January.....	22,886	3,474	26,360
February.....	13,816	2,176	15,992
March.....	12,668	3,150	15,818
April.....	17,880	16,326	34,206
May.....	31,442	25,600	57,022
June.....	45,886	31,840	77,726
July.....	37,658	41,570	79,228
August.....	19,506	10,686	30,192
September.....	17,880	1,690	19,570
October.....	49,780	974	50,754
November.....	46,758	9,924	56,682
December.....			
TOTALS.....	316,140	147,410	463,550

The above record was furnished by Thomas Berry, Chief Engineer of the Arkansas Valley S. B. and I. L. Co., Lamar, Colo.

## ARKANSAS RIVER DISCHARGES AT AMITY CANAL DAM.

For the Year 1905.

MONTH	Carried by Canal Acre-feet	Amount Passing. Acre-feet	Total Acre-feet
January .....	7,572	9,652	17,224
February.....	4,788	12,196	16,984
March .....	16,944	2,300	19,244
April .....	648	164,156	164,804
May.....	3,328	285,576	288,904
June .....	4,790	167,402	172,192
July.....	5,464	26,506	31,970
August.....	2,966	71,250	74,216
September.....	184	8,066	8,250
October.....		2,054	2,054
November.....		3,410	3,410
December.....		18,514	18,514
TOTALS.....	46,684	771,082	817,766

The above record was furnished by Thomas Berry, Chief Engineer of the Arkansas Valley S. B. and I. L. Co., Lamar, Colo.



# ARKANSAS RIVER DISCHARGES AT AMITY CANAL HEADGATE.

For the Year 1906.

MONTH	Carried by Canal Acre-feet	Amount Passing. Acre-feet	Over Dam. Acre-feet	Total Acre-feet
January.....		12,200		12,200
February.....		5,298		5,298
March.....	692	4,704		5,396
April.....	12,016	1,872	18,300	32,188
May.....	14,392	3,728	240	18,360
June.....	16,684	4,308	20,544	41,536
July.....	18,040	4,106	123,640	145,786
August.....	10,636	3,700	90	14,426
September.....	10,962	1,784	11,448	24,194
October.....	3,938	5,450		9,388
November.....		13,880	500	14,380
December.....				
TOTALS.....	87,360	61,030	174,762	323,152

The above record was furnished by Thomas Berry, Chief Engineer of the Arkansas Valley S. B. and I. L. Co., Lamar, Colo.



Lifting Apparatus for the Head Gates of Larimer County Ditch, Cache la Poudre River, Larimer County.



Head Gates of North Poudre Canal, Water District No. 3.



## PURGATOIRE RIVER AT HIGBEE, COLORADO.

For the Year 1906.

STAGE OF WATER	MONTH											
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Maximum.....					30	160	6,000	500	450			
Minimum.....					2	2	3	30	15			
Mean.....					11	27	789	80	107			

May record is from May 15th to May 31st.

GRAND RIVER DRAINAGE.  
Table of Discharge in Second-feet of Grand River at Gore Canon.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1903	Maximum.....											708	786
	Minimum.....											384	429
	Mean.....											*565	565
1904	Maximum.....	657	532	734	3,700								
	Minimum.....	411	446	491	520								
	Mean.....	458	475	544	1,637								

\*Nov. 5-30.



**LOS PINOS RIVER DRAINAGE.**  
**Table of Discharge in Second-feet of Los Pinos or Pine River at Ignacio.**  
**Drainage Area, 450 Square Miles.**

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1906	Maximum.....				2,090	5,800	7,000	850					
	Minimum.....				300	720	50	*280					
	Mean.....				877	2,435	3,162	551					

\*July 25-31.

SOUTH PLATTE RIVER DRAINAGE,  
Table of Discharge in Second-feet of South Platte River at 15th St., Denver.  
Drainage Area, 3,840 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
*1904	Maximum.....	65	69	85	235	710	1,080	823	700	431	418	205	
	Minimum.....	15	33	28	45	168	235	75	170	65	75	75	
	Mean.....	46	49	56	101	369	432	351	381	238	140	118	
†1905	Maximum.....	230	376	385	1,940	1,904	1,760	420	445	310	210	136	201
	Minimum.....	32	45	80	318	1,370	290	131	117	117	85	92	78
	Mean.....	82	125	171	823	1,715	867	281	236	186	117	110	97
*1906	Maximum.....	128	124	231	645	960	620	747	540	440	690	808	
	Minimum.....	58	55	55	60	398	190	176	203	190	279	238	
	Mean.....	78	89	109	233	719	368	334	284	298	410	524	

\*Two rating tables used.      †Three rating tables used.

TABLE OF DISCHARGE IN SECOND-FEET OF SOUTH PLATTE RIVER AT FORT LUPTON.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1906	Maximum					1,320	1,630	1,050	328				
	Minimum					*191	237	145	110				
	Mean					513	411	294	182				

\*May 10-31.

TABLE OF DISCHARGE IN SECOND FEET OF SOUTH PLATTE RIVER AT PLATTEVILLE.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum	.....	.....	.....	.....	.....	.....	268	72	32	168	.....	.....
	Minimum	.....	.....	.....	.....	.....	.....	6	10	*4	40	.....	.....
	Mean	.....	.....	.....	.....	.....	.....	52	34	10	99	.....	.....

\*Sept. 1-24 and 30.

TABLE OF DISCHARGE IN SECOND-FEET OF SOUTH PLATTE RIVER AT ORCHARD.  
Drainage Area, 12,260 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1903	Maximum								125	155			*1,250
	Minimum								30	34			325
	Mean								54	82			586
1904	Maximum	†1,090											
	Minimum	255											
	Mean	781											
1905	Maximum		†1,070	‡535	‡6,110	9,400	8,884			¶190	700	810	325
	Minimum		590	105	370	4,200	230			105	190	45	410
	Mean		970	290	2,388	5,934	4,136			146	363	352	77
1906	Maximum	296	‡296		1,380	2,050	782	1,280	125	1,210	2,130	2,436	
	Minimum	‡152	188		188	94	67	41	20	125	740	1,098	
	Mean	214	261		428	1,038	256	284	59	485	1,308	1,711	

\*Dec. 1-16 and 23-30. †Jan. 1-24. ‡Readings taken on alternate days. ¶Sept. 15-30. x Feb. 1-17.



TABLE OF DISCHARGE IN SECOND-FEET OF BIG THOMPSON CREEK AT ARKINS,  
(BELOW HANDY DAM.)

Drainage Area, 305 Square Miles

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum							*172	315	251	146	90	62
	Minimum							264	160	74	40	30	30
	Mean							365	226	120	75	55	48
1905	Maximum	40	†48	.....	475	840	1,590	677	x378	¶40	57	70	‡97
	Minimum	17	17	.....	4	191	645	322	97	29	29	13	21
	Mean	29	31	.....	170	461	1,048	470	193	39	42	42	44
1906	Maximum	†107	107	‡60	342	750	1,340	2,600	300	v255	187	212	
	Minimum	30	‡20	v15	60	195	457	380	139	†117	70	50	
	Mean	61	69	37	174	427	715	614	207	168	127	148	

\*July 16-31. †Feb. 1-17. xAug. 1-26. ‡Sept. 21-30. vSept. 1-8 and 23-30. †Readings on alternate days.

NOTE—Monthly discharge does not include water in Handy Ditch. During the flood on July 7, 1906, the bridge at gaging station was washed away and channel materially changed. There is no relation between present rod readings and previous rating tables.

TABLE OF DISCHARGE IN SECONDFEET OF BOULDER CREEK AT BOULDER.  
Drainage Area, 179 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum.....							*352	652	121	†68		
	Minimum.....							200	96	42	22		
	Mean.....							246	160	64	37		
1905	Maximum.....			‡33	459	632	779	488	194	495			
	Minimum.....			11	39	272	459	194	58	31			
	Mean.....			20	156	415	617	257	109	56			
1906	Maximum.....				‡216	685	802	497	230	130	115	216	
	Minimum.....				70	202	295	156	64	64	37	24	
	Mean.....				160	388	466	296	141	106	65	91	

\*July 14-31. † Oct. 1-29. ‡ Readings taken on alternate days. § Sept. 1-23. x April 11-30.

TABLE OF DISCHARGE IN SECOND-FEET OF CACHE LA POUUDRE RIVER AT WEIR IN CANON.  
Drainage Area, 1,060 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1903	Maximum.....				*494	1,461	3,768	12,033					
	Minimum.....				170	404	1,464	662					
	Mean.....				277	771	2,713	1,128					

\* April 15-30      † July 1-20.      Gaging taken by Colo. Agri. College.

TABLE OF DISCHARGE IN SECOND-FEET OF CACHE LA POUDRE RIVER NEAR MOUTH.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum							*43	44	62	153	143	
	Minimum							42	38	40	42	80	
	Mean							42	42	43	106	101	

\* July 20-31.

TABLE OF DISCHARGE IN SECOND-FEET OF SOUTH BOULDER CREEK AT MARSHALL.  
Drainage Area, 125 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum.....	.....	.....	.....	.....	.....	.....	*167	142	75	37	26	†16
	Minimum.....	.....	.....	.....	.....	.....	.....	86	52	22	20	14	12
	Mean.....	.....	.....	.....	.....	.....	.....	118	67	38	25	18	15
1905	Maximum.....	†5	†4	†21	460	440	570	226	67	31	13	13	†9
	Minimum.....	3	2	5	31	254	226	67	21	9	5	2	3
	Mean.....	4	3	15	144	324	366	107	33	15	9	4	5
1906	Maximum.....	†6	†9	.....	218	415	503	248	66	83	74	59	.....
	Minimum.....	3	5	.....	13	210	210	75	30	30	40	6	.....
	Mean.....	5	6	.....	94	291	314	158	47	50	56	37	.....

\* July 14-31. † Readings taken twice a week. ‡ On alternate days.

NOTE—Monthly discharge does not include water in Community Ditch and South Boulder and Coal Creek Ditch.



TABLE OF DISCHARGE IN SECOND-FEET OF ST. VRAIN CREEK AT LYONS.  
Drainage Area, 209 Square Miles.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum.....							575	234	234	83	35	
	Minimum.....							227	131	41	29	14	
	Mean.....							332	175	99	52	24	
1905	Maximum.....					685	1,440	428	214	116			
	Minimum.....					286	445	214	80	32			
	Mean.....					438	851	277	146	59			
1906	Maximum.....				*344	780	1,020	685	280	220			
	Minimum.....				192	265	265	235	96	46			
	Mean.....				281	398	464	346	180	109			

\* Apr. 10-31. Note—Monthly discharge does not include water in Supply ditch.

TABLE OF DISCHARGE IN SECOND-FEET OF ST. VRAIN CREEK NEAR MOUTH.

YEAR	STAGE OF WATER	MONTH											
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1904	Maximum.....	.....	.....	.....	.....	.....	.....	256	110	117	91	63	*97
	Minimum.....	.....	.....	.....	.....	.....	.....	73	45	45	63	57	57
	Mean.....	.....	.....	.....	.....	.....	.....	137	64	60	78	59	64
1905	Maximum.....	†116	†132	†116	†1,986	†1,884	2,680	217	190	141	84	100	100
	Minimum.....	71	84	71	100	1,075	221	92	84	53	53	71	42
	Mean.....	94	120	84	637	1,541	1,167	147	122	80	65	78	67
1906	Maximum.....	†126	*95	†151	985	1,621	413	603	151	375	364	451	.....
	Minimum.....	28	60	60	90	160	60	100	85	70	119	142	.....
	Mean.....	78	72	87	362	729	200	200	98	132	180	224	.....

\* Readings taken twice a week.

†Once a week. ‡ On alternate days.

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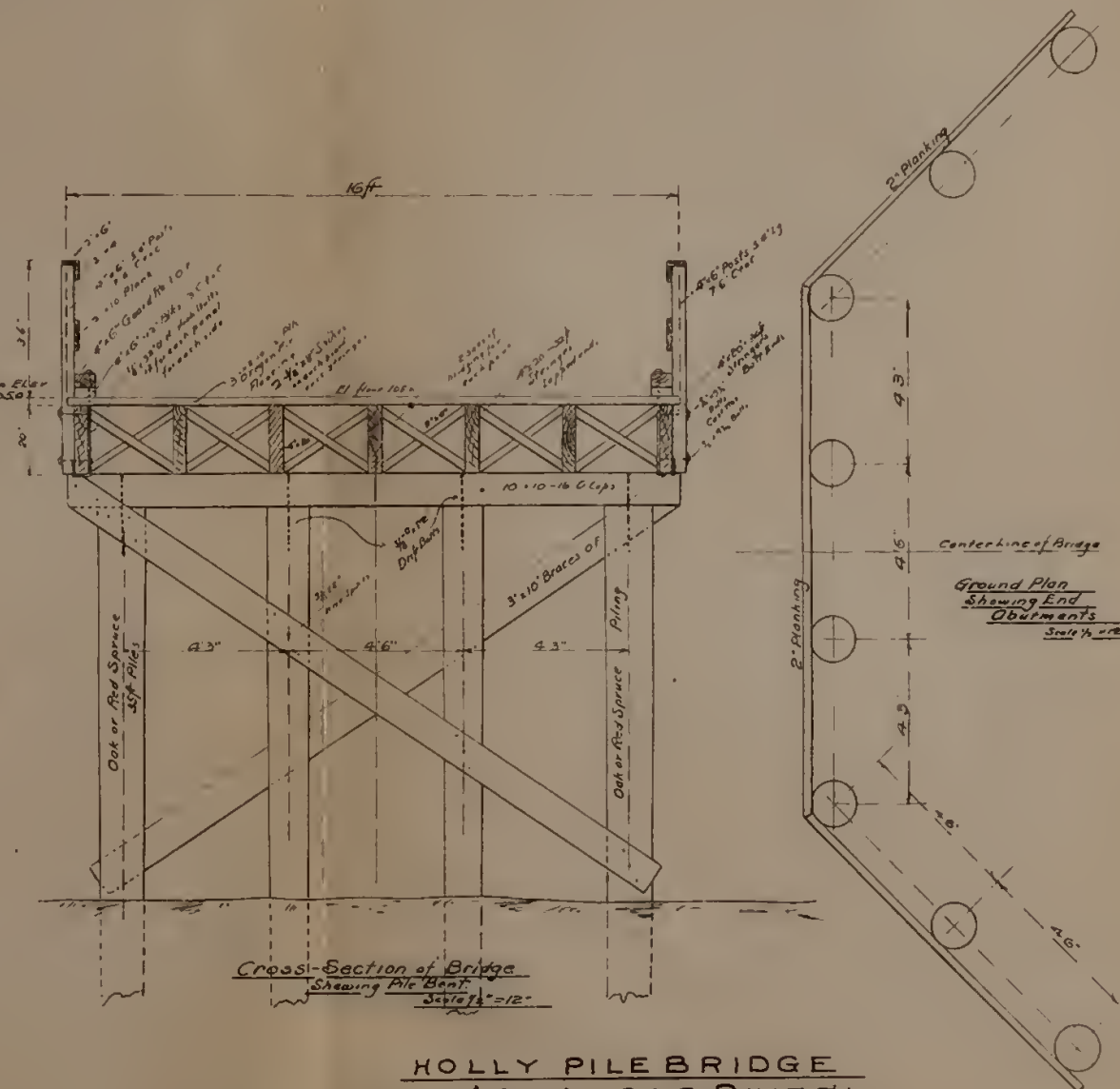
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Top of floor Dr El 103.

28 Span 30 Each Total length - 870 ft.

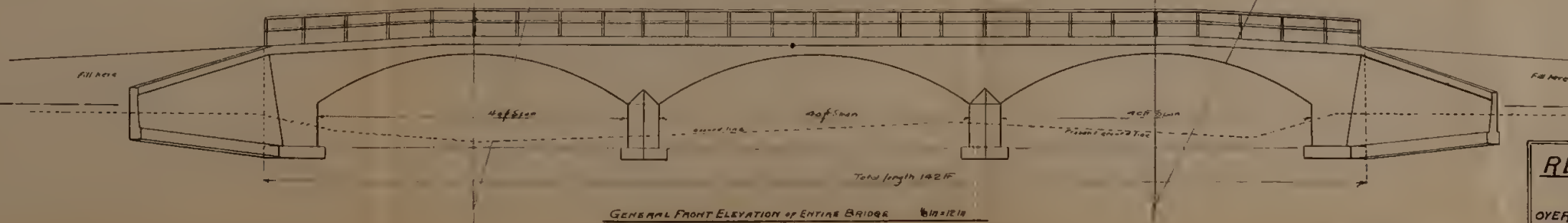
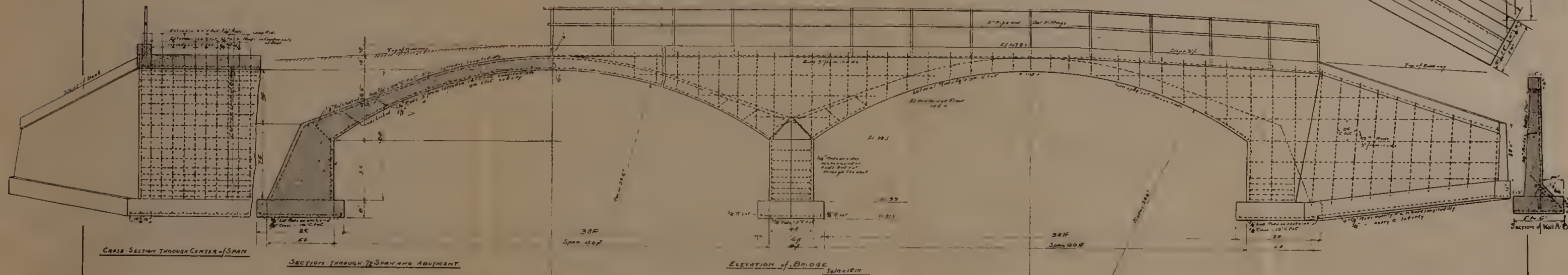
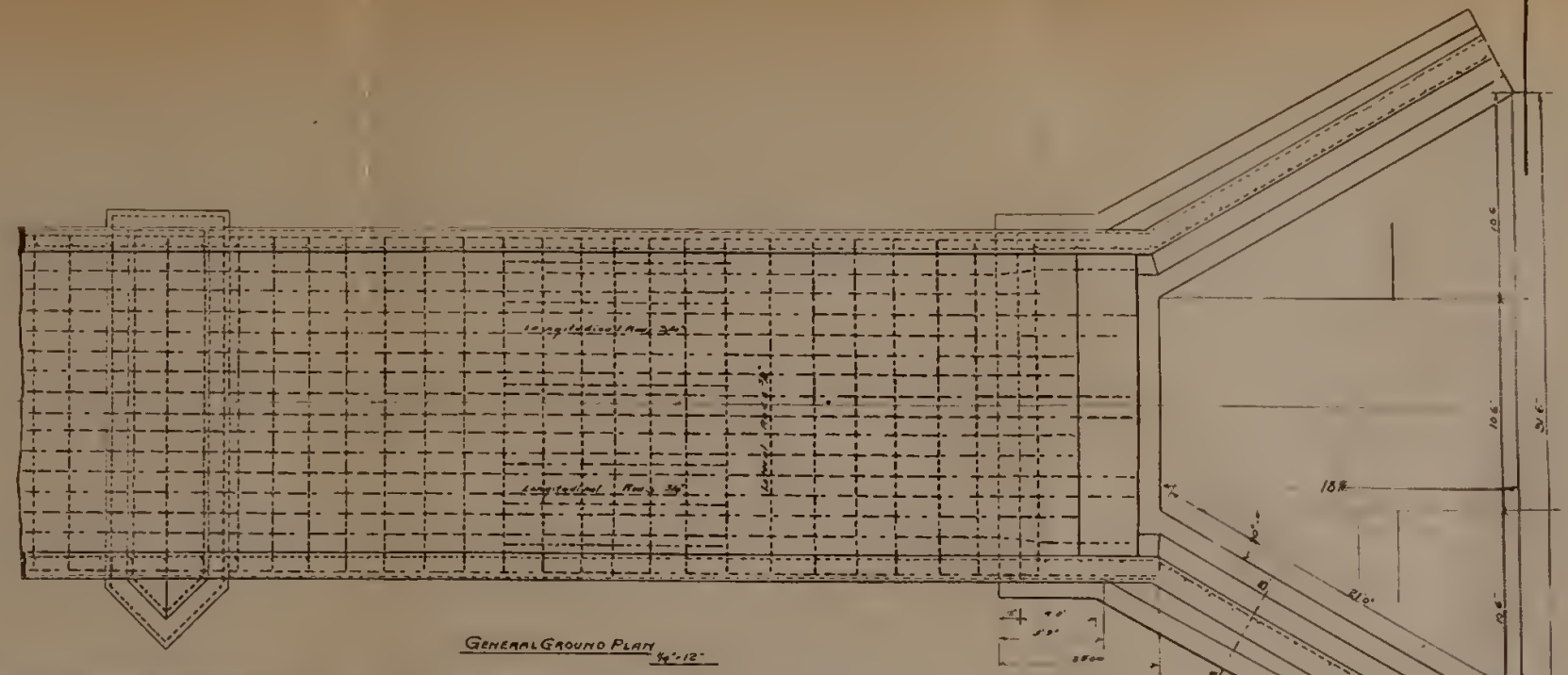
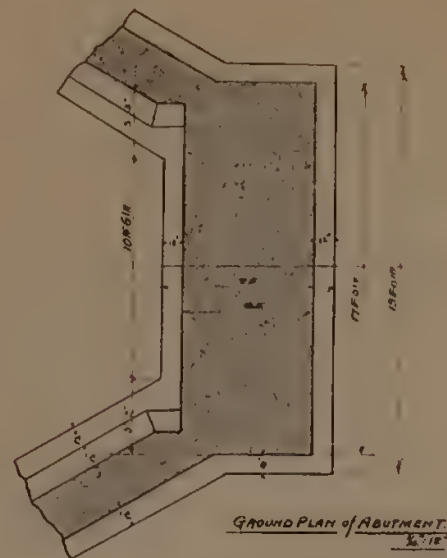


HOLLY PILE BRIDGE  
OVER ARKANSAS RIVER  
AT HOLLY

KNOWN AS PROWERS CO BRIDGE  
STATE ENGINEERS' OFFICE 1905 -- DENVER, COLORADO

Approved

*J. H. Lawrence*  
State Engineer



Designed by Geo H Angell

REINFORCED CONCRETE  
BRIDGE

OVER CONEJOS RIVER NEAR

GUADALUPE

CONEJOS COUNTY COLO.  
H. B. No. 181-1905

STATE ENGINEER'S OFFICE, DENVER

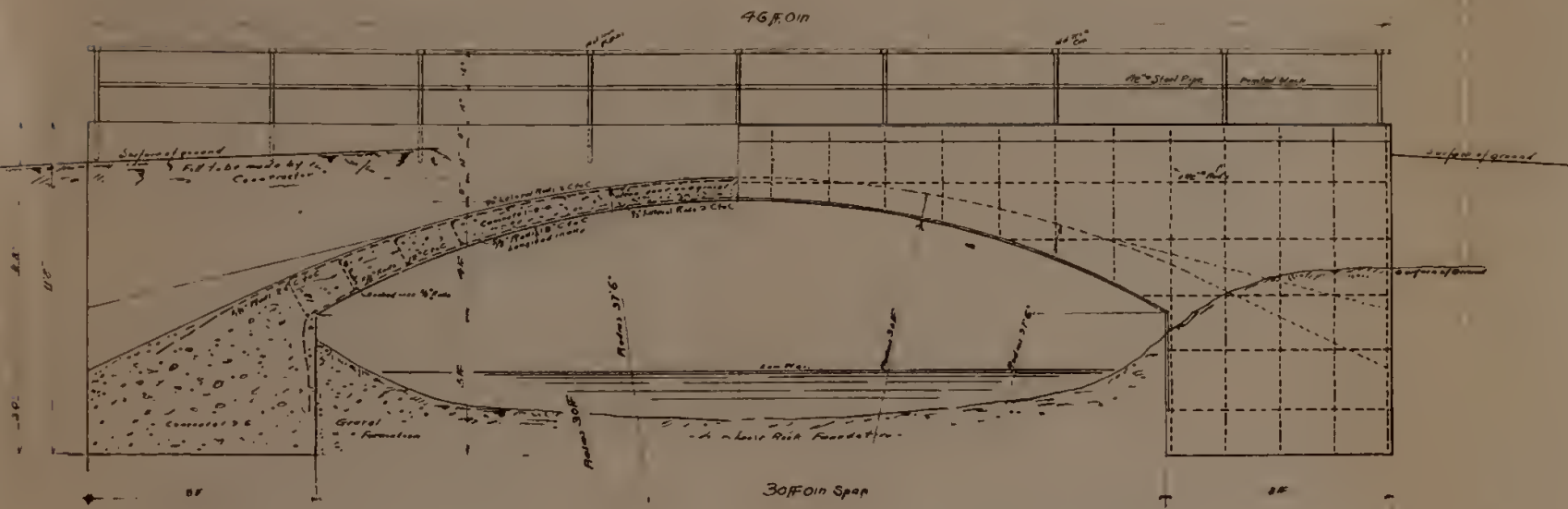
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Approved  
by J. M. Ravano State Engineer  
Dated March 18th 1906



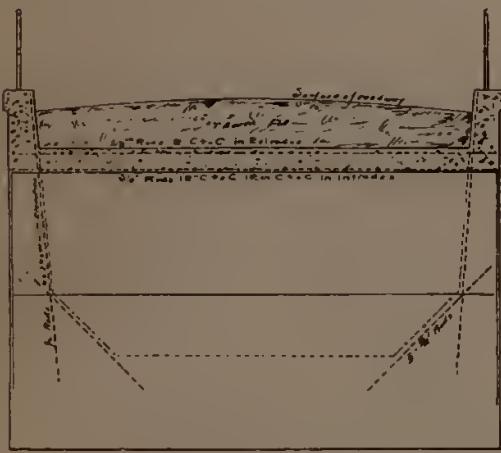




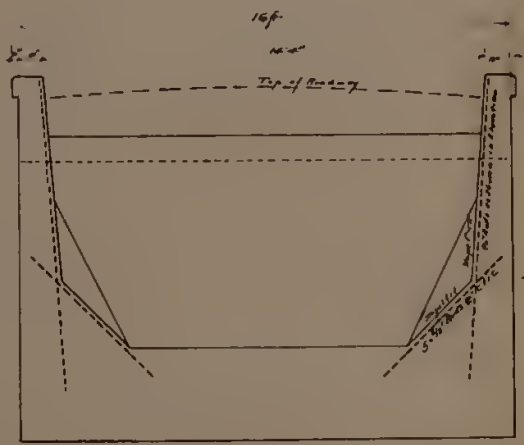
ONE HALF SECTION.

ONE HALF SIDE ELEVATION.

Scale 1/8" = 12'



CROSS-SECTION.



END VIEW.

Scale 1/8" = 12'

Approved Denver May 1 1906

*V. H. Lyon*  
State Engineer

**REINFORCED CONCRETE ARCH BRIDGE**  
— over —  
**CANON CREEK**  
**SIX MILES WEST OF GLENWOOD SPRINGS**  
**GARFIELD COUNTY**  
ON DENVER AND GRAND JUNCTION N.G. ROAD.  
Tennessee Pass to De Beque Section  
STATE ENGINEERS OFFICE, DENVER, COLORADO.  
1906











THE ENGINEERING COLLEGE OF NEW BRUNSWICK

